

# NATURAL SCIENCE

## A Monthly Review of Scientific Progress

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### NOTES AND COMMENTS

FOUND—AN EDITOR

OUR readers will be glad to learn that *Natural Science* will continue to appear as heretofore during 1899 and, we hope, for many years to come. Arrangements have been made for its transfer to an Editor in whom we have every confidence, and who has undertaken to continue the journal on the lines with which our readers are familiar. Particulars as to the future editorial and publishing offices will be given in our December number.

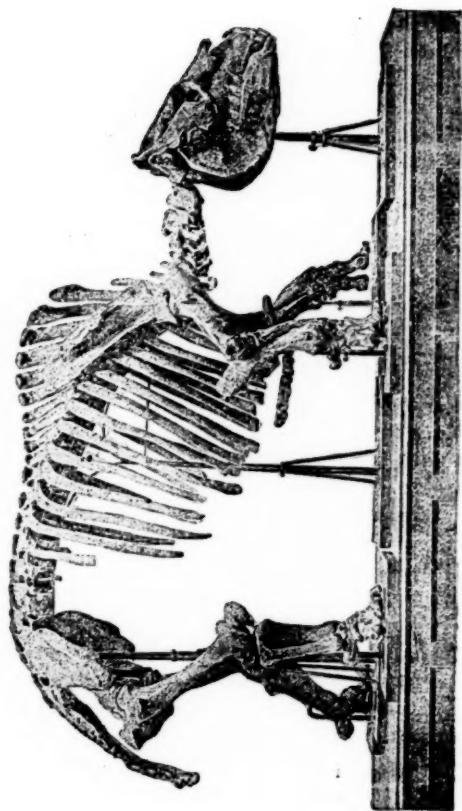
#### DISTRIBUTION OF THE OCEANS AND CONTINENTS

IN discussing the theories of the distribution of the Oceans and Continents before the British Association, Dr J. W. Gregory remarked that the "main object of geomorphology is to explain the existing distribution of land and water on the globe. A remarkable series of coincidences in the form and arrangement of the land masses suggests that the distribution has been determined by some general principle and not by local accidents. The three most striking features that require explanation are the antipodal position of oceans and continents, the triangular shape of the geographical units, and the excess of water in the southern hemisphere. Attempts to explain this arrangement have been made deductively from general physical considerations, as by Elie de Beaumont, Lowthian Green, and G. H. Darwin; and directly from the evidence of stratigraphical geology as by Suess, Lapworth, and Michel-Levy. Thus Elie de Beaumont regarded the form of the continents as determined by the mountain chains, which he correlated into a regular geometrical network; while Lapworth regarded the distribution of land and water as due to a series of great earth-folds, the arches forming the continents, and the troughs forming the ocean basins. Suess has treated the

subject synthetically; he has shown that the structure of the world can be explained by subsidences in the crust, when subterranean support is removed by the shrinkage of the internal nucleus, and by the movements of elevation which produce the chains of fold-mountains. Suess's view explains the structure of the continents and ocean basins, but not their arrangement. To settle this problem fuller knowledge is needed as to the distribution of land and water in past times. Neumayr's attempt to settle this question for the Jurassic was premature, and his conclusions are untenable. We are thus still dependent upon the deductive systems for suggestions as to the most profitable lines of research. Elie de Beaumont's famous scheme attached undue importance to linear symmetry and was too artificial. It led, however, to the tetrahedral theory of Lowthian Green, which regards the world, not as shaped like a simple tetrahedron, but as a spheroid slightly flattened on four faces. Such flattenings occur on hollow, spherical shells, when they are deformed by uniformly distributed external pressure. The oceans would occupy the four depressions thus produced, while the land masses occur at the angles and along the edges. The existing geographical arrangement is in general agreement with this scheme; for as the tetrahedron is hemihedral the assumption that the lithosphere is tetrahedral explains the antipodal position of land and water, the excess of water in the southern hemisphere, and the southward tapering of the land masses. The main lines of the existing system of fold-mountains have a general agreement with the arrangement of the edges of a tetrahedron. Some striking deviations occur, but are explicable by the variations in the composition of the lithosphere, and the existence of impassive blocks of old strata which have moulded the latter movements. The lines of the old fold-mountains of the Hercynian system may have been tetrahedrally arranged, but with the axes occupying different positions from those of the great Cainozoic mountain system. So far, however, there is no completely satisfactory theory of geomorphology, for which we must wait for further information as to the distribution of land and water in successive epochs of the world's history. For the historical method promises more reliable results than the deductive method."

#### TOXODON

THE important serial publications of the Museum of La Plata, Argentina, contain some of the most valuable contributions to natural science which have been made during the last decade. We have had frequent occasion to refer to them, and to the vast store of unique specimens which the energy and genius of Dr F. P. Moreno have accumulated in the comparatively new capital of the State of Buenos Aires. The *Revista* and *Anales*, however, contain only



SKELETON OF *Turodon*,  
AS MOUNTED IN THE LA PLATA MUSEUM

general memoirs and papers, without any detailed statistics of the Museum collections. The Director has thus wisely decided to begin a third set of publications, namely, a series of Catalogues recording the specimens in the Museum under their register-numbers, with brief descriptions and illustrations, somewhat on the plan of the Catalogues of the British Museum. The first of these publications, just issued, relates to the Department of Palaeontology, and is entitled "Catálogo de los Mamíferos Fósiles conservados en el Museo de la Plata." Only the first section is before us, namely that comprising the type-genus of the ungulate order, *Toxodontia*, by Dr Santiago Roth, curator of the fossils. No less than 128 pages, with 81 text-figures and 8 plates, are devoted to this characteristic genus of extinct South American hoofed animals. The well-known figure of the nearly complete skeleton of *Toxodon* at La Plata, which we reproduce herewith, has now found its way into most recent text-books. The student of mammals has thus known for some years what to expect from a detailed account of the specimens of *Toxodon* in the La Plata Museum; and now for the first time he is furnished with tolerably adequate descriptions. The characters of the various parts of the skeleton are first systematically described; and then the species are successively diagnosed, while a numbered list of specimens is placed beneath each. Although numerous new facts are recorded, it would still be premature to say more concerning the affinities of *Toxodon* than has already been said by previous observers. We now want to know more of *Nesodon* and its ancestors, which are found in Patagonia, before the relationships of this strange group of ungulates can be further discussed.

#### FOSSIL OSTRICH IN CHINA

ABOUT 1857, a remarkable fossil egg was discovered at Malinowka, Government of Cherson, S. Russia, which though now destroyed and lost, was seen by Prof. A. Brandt of Charkow and described by him in the Bulletin of the St Petersburg Academy in 1873. Nathusius examined some of the fragments microscopically, and declared that they indicated a very close relationship with the common ostrich. The egg as a whole, however, had a cubic contents of upwards of 2075 c.cm., while the largest known egg of the ostrich has only two-thirds this capacity. The microscopical structure being very characteristic of the group he referred the egg to a new genus and species *Struthiolithus chersonensis*. No bones of the bird that left behind the egg are known, but ostrich remains have been described from the Pliocene of the Sivalik Hills and the lower Pliocene of Samos. The fragments of the Cherson egg are still preserved in St. Petersburg Museum. Considerable interest is now attached therefore to a paper by Mr C. R. Eastman, which

forms number 7 of the thirty-second volume of the *Bulletin of the Museum of Comparative Zoology at Harvard College*, in which is described and figured an entire and perfect specimen of an ostrich egg which was found a few years ago by a Chinese farmer at Yao Kuan Chuang, district of Hsi Ning, about fifty miles south south-west from Kalgan. The find consisted of two specimens, one of which was broken, and is perfectly well authenticated by the Rev. Wm. P. Sprague, who visited the spot in company with the man who found them and secured the unbroken specimen, which is now in the Harvard Museum. According to Mr Sprague's account, corroborated by references to Richthofen's China, the deposit from which the egg came was Loess. The egg itself presents almost exactly the same appearance as the Russian egg, of which a plaster cast is preserved, and in the opinion of Mr Eastman it may be considered at present to belong to the same bird. The cubic contents of the Chinese egg is 1896.90 c.cm. The occurrence of fossil ostrich remains in the Loess of such widely separated regions as Northern China and Russia has a direct bearing upon the distribution of Struthious birds, and gives rise to some important inferences by Mr Eastman, regarding the past history of Ratite birds in general.

#### THE NOTES OF BIRDS

MANY a wanderer in the country has wished that he could identify the various birds that he hears singing on the hedges or calling in the fields. Those who live in the country often know the call, but can only identify the bird by its local name. Mr Charles Louis Hett of Brigg has produced a small octavo volume, handy for the pocket, which is to be obtained for half-a-crown of Messrs Jackson, Market Place, Brigg, which gives these notes and calls arranged in alphabetical order, most of which give a fair idea of the various sounds produced. Further than this, Mr Hett has also given a list of the popular local and old-fashioned names of British birds, under each of which the notes are repeated, and closes his little volume with a list of the scientific names of all birds accepted as British by the British Ornithologists' Union in 1883. Equipped therefore with this volume, the bird lover may identify, with a certain approach to accuracy, many of the birds met with in his rambles, and what is of greater importance, may, now he has a basis to go upon, try and record more accurately the delusive and fugitive calls of many of the species.

#### LIFE CONDITIONS OF THE OYSTER

THE following conclusions of the Committee appointed by the British Association to report on the elucidation of the life conditions of the

oyster under normal and abnormal environment, including the effect of sewage matters and pathogenic organisms, drawn up by Professor Herdman, Professor Boyce, and Dr Kohn, are, we think, of sufficient interest to the public to repeat here in full.

1. There are several distinct kinds of greenness in oysters. Some of these, such as the green Marennes oysters and those of some rivers on the Essex coast, are healthy; while others, such as some Falmouth oysters containing copper and some American oysters re-bedded on our coast and which have the pale-green leucocytosis we described in the last report, are not in a healthy state.

2. Some forms of greenness (*e.g.*, the leucocytosis) are certainly associated with the presence of a greatly-increased amount of copper in the oyster, while other forms of greenness (*e.g.*, the Marennes) have no connection with copper, but depend upon the presence of a special pigment Marennin, which may contain a certain amount of iron.

3. We see no reason to think that the iron in the latter case is taken in through the surface epithelium of the gills and palps; but regard it, like the rest of the iron in the body, as a product of ordinary digestion and absorption in the alimentary canal and liver.

4. We do not find that there is any excessive amount of iron in the green Marennes oyster compared with the colourless oyster; nor do the green parts (gills, palps, &c.) of the Marennes oyster contain either absolutely or relatively to the colourless parts (mantle, &c.) more iron than colourless oysters. We therefore conclude that there is no connection between the green colour of the Huitres de Marennes and the iron they may contain.

5. On the other hand, we do find by quantitative analysis that there is more copper in the green American oyster than in the colourless one; and more proportionately in the greener parts than in those that are less green. We therefore conclude that their green colour is due to copper. We also find a greater quantity of iron in these green American oysters than in the colourless; but this excess is, proportionately, considerably less than that of the copper.

6. In the Falmouth oysters containing an excessive amount of copper, we find that much of the copper is certainly mechanically attached to the surface of the body, and is in a form insoluble in water, probably as a basic carbonate. In addition to this, however, the Falmouth oyster may contain a much larger amount of copper in its tissues than does the normal colourless oyster. In these Falmouth oysters the cause of the green colour may be the same as in the green American oysters.

7. The Colon group of bacilli is frequently found in shellfish, as sold in towns, and especially in the oyster; but we have no evidence that it occurs in Mollusca living in pure sea-water. The natural inference that the presence of the Colon bacillus invariably indicates sewage contamination must, however, not be considered established without further investigation.

8. The Colon group may be separated into two divisions—(1) those giving the typical reactions of the Colon bacillus, and (2) those giving corresponding negative reactions, and so approaching the typhoid type; but in no case was an organism giving all the reactions of the *B. typhosus* isolated. It ought to be remembered, however, that our samples of oysters, although of various kinds and from different sources, were in no case, so far as we are aware, derived from a bed known to be contaminated or suspected of typhoid.

9. Consequently, as the result of our investigations, and the consideration of much evidence, both from the oyster-growers' and the public health officers' point of view, we beg to recommend:—

(a) That the necessary steps should be taken to induce the oyster trade to remove any possible suspicion of sewage contamination from the beds and layings from which oysters are supplied to the market. This could obviously be effected in one of two ways, either (1) by restrictive legislation and the licensing of beds only after due inspection by the officials of a Government department, or (2) by the formation of an association amongst the oyster-growers and dealers themselves, which should provide for the due periodic examination of the grounds, stores and stock, by independent properly-qualified inspectors. Scientific assistance and advice given by such independent inspectors would go far to improve the condition of the oyster beds and layings, to reassure the public, and to elevate the oyster industry to the important position which it should occupy.

(b) Oysters imported from abroad (Holland, France, or America) should be consigned to a member of the "Oyster Association," who should be compelled by the regulations to have his foreign oysters as carefully inspected and certificated as those from his home layings. A large proportion of the imported oysters are, however, deposited in our waters for such a period before going to market that the fact of their having originally come from abroad may be ignored. If this period of quarantine were imposed upon all foreign oysters, a great part of the difficulty as to inspection and certification would be removed.

(c) The grounds from which mussels, cockles and periwinkles are gathered should be periodically examined by scientific inspectors in the same manner as the oyster beds. The duty of providing for

this inspection might well, we should suggest, be assumed by the various Sea Fisheries Committees around the coast.

#### THE METHOD OF FEEDING OF *HELIX HORTENSIS*

MR E. RATHAY publishes an interesting article on the method of feeding of *Helix hortensis*, in the third part of Vol. viii. of the *Zeitschrift für Pflanzenkrankheiten*.

The author had noticed on the smooth bark of ash-trees certain undulating patterns, in the immediate neighbourhood of which, or at their extremities, were individuals of *Helix hortensis*. Mr Rathay therefore felt that the patterns must be accounted for by the snail's method of feeding.

To make certain of the fact, he took some bits of ash-bark on which no patterns had been traced, set them in an upright position so as to keep them fresh in the water, put a *Helix* on each, and covered them over with a glass bell. The very next day, these bits of bark showed traces of undulating patterns.

In consequence of this experiment, the author's attention was drawn to other smooth-barked trees, and he recognised the same patterns on *Salix caprea* L., *S. amygdalina* L., *Alnus incana* C., &c.

These traces were noticed on the trunks to the height of 7 to 9 metres, and the snail that was observed to be at work, produced them by slowly advancing his body and swaying his head alternatively to right and left.

One might suppose that the gasteropod fed himself thus by gnawing the bark of the tree, but it is nothing of the kind; he attacks the spots where the bark is powdered with a small alga, *Pleurococcus vulgaris*, Menegh., and scarcely touches the outer skin of the bark.

In fact, in the excrement of *Helix hortensis* are found the cells of *Pleurococcus* almost intact.

In accordance with the experiments detailed in the note and after the employment of various appropriate reagents, it is recognised, not only by microscopic examination, but by chemical experiment, that the cells of *Pleurococcus* have been evacuated intact with their chlorophyl.

The author's conclusions are as follows:—

1. It is only on smooth barks sufficiently coated with alga that the undulating patterns can be detected.

2. It can easily be observed, especially on the older trees, that *Helix hortensis* does not eat the outer skin of the bark and scarcely touches it.

3. The excrement of the same gasteropod, taken a great height up the tree, is chiefly composed of cells of *Pleurococcus* with very few fragments of peridermis. The extraordinary thing about

this is that these cells are evacuated apparently intact, not only with their chlorophyl, but with the other substances that they contain.

4. It has been noticed that *Helix hortensis* produces the same patterns on the lattice work of a wooden fence covered with *Pleurococcus vulgaris*. A figure of the pattern referred to will be found reproduced in *La Feuille des jeunes Naturalistes*, September, from which journal we take this note.

#### ABNORMAL SHELLS OF PLANORBIS

THE abnormalities of our fresh-water snails will be no new fact to bring before the notice of our readers, but attention may well be directed to a paper by Mr A. G. Stubbs on abnormal specimens of *Planorbis spirorbis* from Tenby. The paper was read before the Conchological Society, and is published in the October number of their *Journal*. A good plate is provided, and the shells are seen to be contorted in every direction, but mainly into that of a spiral, some of these so much drawn out as to be nine or ten times the height of the normal shell. Mr Stubbs accepts Mr J. W. Taylor's explanation as to the cause of this curious distortion:—"that when the water [in this ditch] is nearly dried up, the efforts of the creatures in forcing their way through the thick mud in which they are sometimes left partially embedded, to again reach the water, may easily cause an alteration in the direction of a new shell growth, if at the time in course of formation."

#### A REMARKABLE MARINE ORGANISM

AMONG a number of sponges from Rámésvaran Island, Gulf of Manaar, sent to Dr Arthur Dendy for identification for the Madras Museum, were some fifteen specimens of cushion-shaped masses of a brown colour, from 13 mm. to 36 mm. in diameter, attached to rock fragments. These masses are compact and tough in texture, after preservation in spirit, like indiarubber, and there is a deal of sand in the deeper layers. When cut in half vertically they show strongly-marked, concentric lamellae, the effect of alternating bands of flocculent (opaque) and transparent layers. The opaque layers are connected together by a coarse network of radially ramifying strands. In the transparent layers are seen, after careful examination, innumerable exceedingly slender unbranched threads, which prove to be the cellulose sheaths of chains of short, rod-like bacteria. Dr Dendy thinks that there are two possible views as to the nature of *Pontobolbos*, as he calls this remarkable structure, and these are (1) that the organism is entirely bacterial in origin, the

opaque layers and network being due to the formation of slime or jelly by the bacteria themselves, or (2) that it is due to symbiosis between the bacteria and some gigantic rhizopod, the protoplasm of which is seen in the flocculent layers and network. After discussing these two views, Dr Dendy calls attention to the marvellously close resemblance of *Pontobolbos* to the enigmatical fossils Stromatoporidae. The paper appeared in the Linnean Society's Journal, volume twenty-six.

#### 'BUGS' AS FOOD

MR G. W. KIRKALDY, who has been devoting his attention for some time to the systematic description of the Rhynchota, has written a short note to the *Entomologists' Monthly Magazine* (p. 173) on arrangements which have been made for the importation into this country both of imagoes and ova of *Notonecta* and *Corixa* in large quantities for the food of insectivorous birds, game, fish, and others with peculiar tastes. It has long been known that the natives of parts of Mexico eat the perfect insects with relish, and that the sale of cakes made of the ova is fairly extensive. The species to be imported, according to Mr Kirkaldy, are *Notonecta americana*, Fabr., and *Corixa mercenaria*, Say. The ova are called by the Mexicans 'Axayacatl' or 'waterface,' and are made into cakes with the addition of meal. These are eaten *au naturel* or with green chilies. If cooked without meal they are called 'ahuantli' or 'water wheat,' have the appearance of fish roe, have a delicate flavour, and are not disdained at fashionable tables. Virlet d'Aoust indeed compared them to caviare. Mr Kirkaldy, however, cannot speak highly of them as a relish, his were stale and tasted of sulphuretted hydrogen and decayed animal substances. The perfect insects, moreover, had a distinct 'buggy' flavour. Still one can educate one's palate, and there are some who revel in the pope's nose of a goose despite its taste of cockroach. The *C. mercenaria* are imported by the ton, and each ton is imputed to contain 250 millions of insects. We will not dine with Mr Kirkaldy.

#### THE RELATIONSHIPS OF BUTTERFLIES

READERS of *Natural Science* will recall Mr A. Radcliffe Grote's papers at the beginning of the present year (vol. xii. pp. 15-26, 87-99) on the classification of butterflies according to the wing-venuration. His main contention was the separation of the Papilionidae from all the other butterflies on account of the presence of a short vein (ix.) next to the inner margin of the forewing, this vein being absent in all the other families. In a recent paper entitled "Specialisations of the Lepidopterous Wing; the Pieri-Nymphalidae," in the *Proc. Amer. Phil. Soc.* (vol. xxxvii. pp. 17-

44, pls. i-iii.), Mr Grote considers in detail the neurulation in certain genera of the "Whites" and the "Brush-footed butterflies," which he believes to be rather closely related to each other.

Meanwhile Dr K. Jordan has published a study of butterfly-feelers ("Contributions to the Morphology of the Lepidoptera; the Antennae of Butterflies," *Nov. Zoolog.*, vol. v. pp. 374-415, pls. xiv., xv.) which has led him in many respects to conclusions at variance with those of Mr Grote. From the amount of scaling on the feelers, and the arrangement of grooves with sensations on the ventral surface of their segments, he associates the Nymphalidae and Papilionidae together as the most highly specialised butterflies. In the Nymphalidae there are two ventral grooves on each segment, in the Papilionidae either two or one; the latter condition occurring in the Parnassinae, but their single groove apparently representing one of the lateral grooves in the Papilios. Among the other families, there are either no ventral grooves (Hesperiidae, Lycaenidae), or one (Erycinidae, some Pieridae), or three (other Pieridae).

Dr Jordan's valuable research will be welcomed by all students of the Lepidoptera, and no one can doubt that such characters as he indicates must be taken into account in the discussion of affinities. At the same time, a comparison of his results with those of Mr Grote raises the question whether it is advisable to erect a phylogenetic classification on facts relating only to one set of organs. We are constantly receiving fresh light as new structures are studied, and several modifications of current arrangements seem to be supported by converging lines of evidence. For instance pupal structure (Chapman), wing neurulation (Grote), and antennal characters (Jordan) all combine to indicate that the Hesperiidae and Lycaenidae must be regarded as the most primitive families. On the other hand, Mr Grote's association of the Pieridae with the Nymphalidae and their allies, while supported by the pupal characters elucidated by Dr Chapman, is, as we have seen, contradicted by the feelers as interpreted by Dr Jordan.

It is of interest to note that Mr Grote and Dr Jordan, in these two papers, agree in restoring to the Pieridae the abnormal West African insect *Pseudopontia* (or *Gonophlebia*) *paradoxa*, which Dr Butler and others have been inclined to regard as a moth. Both its wing-neurulation and antennal structure prove it to be an abnormal pierid butterfly.

#### AN ENTOMOLOGICAL CONTROVERSY

In the same volume of the *Novitates Zoologicae* (pp. 435-455) Dr Jordan replies to some aspersions cast on the work of himself and Mr W. Rothschild, by the late Professor Eimer in his recently published "Orthogenesis der Schmetterlinge." Dr Jordan is apparently

in agreement with several of Eimer's conclusions—the inheritance of acquired characters and the small influence of natural selection in the origin of species. His trenchant criticisms of the statements and reasonings by which Eimer supported his conclusions are therefore all the more weighty.

#### THE ORIGIN OF DIATOMACEOUS EARTHS IN NEW JERSEY

THE lacustrine sedimentary deposits of Weequahick Lake, Newark, New Jersey, have been long considered as fresh water deposits of diatomaceæ. Professor Arthur M. Edwards has been recently studying these deposits as represented in the valley of the river Passaic, and in the clay there, which is three feet thick, has found a mixture of marine and fresh water diatoms. He also finds numerous kettle-holes and deposits of a peaty matter all of which contain the diatomaceous earth. From this he concludes "that the whole country in North America, and most likely in Europe also, was covered by a fresh-water sea, derived from the melting ice at the period when icebergs made their appearance, and that the temperature of this sea was  $0^{\circ}$  C. ( $32^{\circ}$  F.), because that is the temperature most congenial to the bacillarias; and the diatomaceous clays described above were laid down as fresh-water deposits from this sea during the iceberg period." The paper forms pp. 103-107 of a Society which is apparently ashamed of its name, for that nowhere appears on the excerpt.

#### THE PERSISTENCE OF SPECIFIC FORMS

IN the above paper is a remark that all the forms noted are of the same kind as are found in various parts of the world; while in a brief note by the same author, and published so long ago as March 1897 in the *American Monthly Microscopical Journal*, we read with reference to some "Tuscarora" soundings: "The same forms are to be found in the Neocene of California whenever it has been examined, from Crescent City in Del Norte county on the north to a spot about forty miles south of the southern limit in Southern California, that is to say into Mexico. They are the same in the infusorial earth of the Atlantic Coast of North America, and likewise in South America when it has been detected at Payta and Mejillones in Peru. In North America it is known as Miocene territory and is seen at Atlantic City in New Jersey, at Richmond in Virginia, at various points in Maryland, as at Nottingham, and at Tampa Bay in Florida. It is likewise known at Oran in Africa, at Moron in Spain, at Mors in Denmark, at Catanisetta in Sicily, at Simbirsk in Russia, and at Senz Peter in Hungary. Besides, it is known at Netanai in Japan and Oamaru in New Zealand."

"And what does this bring us to? We have to compare the

forms of Bacillaria, Rhizopoda and Foraminifera of these different localities and we find them essentially the same in all. We have also to compare the forms of Bacillaria, Rhizopoda and Foraminifera of the soundings in the Pacific and Atlantic oceans and we find them the same. Can we not say that the strata are the same in composition chemically and the same in organic forms?"

"I think they are. And can we separate the Neocene from the recent soundings in any respect? I do not think so. . . . We cannot distinguish Neocene Bacillaria, Rhizopoda or Foraminifera from recent which are living now. Although the strata in New Zealand have been placed in the Cretaceous, and at Simbirsk in the lower Eocene, we must expect to see them bearing like forms to the recent, and which live more on the bottom of the ocean and are in every inlet along the coast." Much of this has been said before, but it will well bear repetition.

#### A TIDAL CRANNOG AT DUMBARTON

AN undoubted crannog of a remarkable type was found recently by the well-known archaeologist, Mr W. A. Donnelly. It is the first of such structures found in tidal waters. The discovery has been inspected by Drs Anderson and Munro, and the latter after making a thorough investigation of the site, declared that "it was the most curious, puzzling, and interesting find of the kind he had met with in all his long experience, and, so far as he knew, unique." Mr H. J. Dukinfield Astley, who communicated this find to the *Athenaeum* (Sept. 10), says that Mr Donnelly, with the help of the Helensburgh Naturalist and Antiquarian Society, has thoroughly investigated the spot with a rich reward. The crannog is 1000 yards east of the Castle Rock of Dumbarton, and about 2000 yards from Dunglass Castle, below high-water mark, and about 50 yards from the river at low tide; when the tide is in it is submerged from 3-12 feet. The approach is from the north. The circuit of the crannog is 184 feet. The piles in the outer circle are of oak, which below the mud surface is still quite fresh; the transverse beams and pavements inside are of wood of the consistency of cheese—these are of willow, alder, and oak; the smaller branches are of fir, birch, and hazel, with bracken, moss, and chips. The stones in the outer circle and along the causeway leading to the dwelling-place seem to be placed in a methodical order, most of the boulders being about a lift for a man. The refuse-mound extends for about 12 feet outside for the greater part of the circuit, and in this the flint and bone implements have been chiefly discovered, while near the crannog itself a canoe, 37 feet long and 40 inches beam, dry ends of an oak tree, was also found.

As regards its construction—of stones, wooden piles and pave-

ments—shape, and the finding of canoe alongside, this crannog differs in no way from other well-known ones in Ireland and elsewhere; but in two respects it is absolutely unique: (1) as was stated above, in being situated on the shores of a tidal river; and (2) in the fact that, so far at any rate, none but implements of flint and bone have been discovered. This would throw its occupation back at least to the Neolithic period, whereas crannogs are usually associated with the Bronze Age, *e.g.*, the British lake village at Glastonbury yielded beautiful specimens of bronze fibulae and other articles. Details as to further finds will, therefore, be eagerly awaited by archaeologists.

#### \*AUSTRALIAN INITIATION CEREMONIES

LIGHT is gradually being let into the remarkable ceremonies of initiation that the young Australian has to pass through before he is admitted to the secrets of the tribe and regarded as a full member of it. Much has been published by the Horn Expedition, and by a recent Government publication, but Professor Baldwin Spencer and Mr F. J. Gillen have now given us the full details of these interesting ceremonies as performed by the Arunta tribe of Central Australia. Mr Gillen is a Sub-Protector of the aborigines, and so has special opportunities of observing, and much of what was glossed over by the earlier observers is now carefully related and explained. Excepting, perhaps, one tribe, the Wótjo-balluk of the Wimmera district, Victoria, every Australian native has to undergo these ceremonies. In the case of the tribes inhabiting the east and south-eastern coastal districts of the continent, the ceremonies appear to be entirely distinct from those of the tribes of the central area, amongst whom they are very elaborate and spread over a long series of years, the first taking place at about the age of ten or twelve, whilst the final and most impressive one is not passed through until the black fellow has reached the age of at least twenty-five or even thirty. The ceremonies described in the *Transactions of the Royal Society of Victoria*, vol. x. part 2, are four in number, and are (1) the Enchíchíhíka and Alkirakiwūma, or painting and throwing the boy up; (2) Lartna or circumcision; (3) Ariltha or subincision; and (4) Engwurra or fire ceremony. One of the most noticeable features of the Arunta ceremonies is the absence of the knocking out of the teeth, but no doubt to-day much of the ceremony in various tribes has lost its old significance, and degenerated or developed along different lines as the tribes separated from their original common centre.

The Australian aborigines also form the subject of a paper by Mr Oliphant Smeaton this month in the *Westminster Review*, who deals with their curious legends.

## NATURAL GAS IN SUSSEX

So long ago as 1875 Mr Henry Willett noticed the discovery of an inflammable natural gas while conducting the Netherfield Boring. In 1895 another discovery was made while boring for water at the new Heathfield Hotel, in the parish of Waldron, East Sussex. Here, at a depth of 228 feet, the foreman noticed that the water in the bore was "boiling," and on applying a candle the gas caught fire and burnt "to about the height of a man." The third discovery was made in August 1896, formed the subject of a paper in our August number, and is now fully described by Mr Charles Dawson and Dr J. T. Hewitt in the Quarterly Journal of the Geological Society for August 1898. About 100 yards from the hotel, in a cutting, the London and Brighton Railway Company, desiring better water supply for their engine tank, put down a 6-inch bore. Gas was noticed for some time, but when the bore had reached 312 feet from the level of the permanent way, the rush was so pronounced that on a match being applied a flame shot up, which was extinguished with difficulty by damp cloths. The gas continued to increase in volume, but as the bore failed to supply the necessary water, it was abandoned at 377 feet. The tubes were then withdrawn, with the exception of the last, to which an iron cap was screwed with an  $\frac{1}{2}$ -inch bend and stop-cock. A continuous escape for eighteen months has occurred with a pressure of 15 lbs. to a square inch in March and one of 20 lbs. on June 11 this year. Analyses were made by Mr S. H. Woodhead, which gave:—

Oxygen . . . .	18
Higher hydrocarbons . .	5.5
Carbon monoxide . .	4.0
Marsh gas . . . .	72.5
	<hr/>
	100.0

and by Mr Hewitt, which gave:—

Methane ( $\text{CH}_4$ ) . . . .	91.9
Hydrogen ( $\text{H}_2$ ) . . . .	7.2
Nitrogen ( $\text{N}_2$ ) . . . .	0.9
	<hr/>
	100.0

The lowest part of the bore seemed to be in the Purbeck strata, which are known to contain a little bituminous matter. But it seems more likely that the gas comes from the underlying Kimmeridge clay, which was richer in petroleum the lower it was penetrated by the Sub-Wealden Boring in 1875.

## THE MOUNT RAINBOW GOLD-FIELD, QUEENSLAND

THE basalt capping of the flat-topped and steep-sloped hills of the Mount Rainbow gold-fields in Queensland rest upon a sediment of wash of 2 or 3 feet of rounded and subangular pebbles and boulders of granite, quartzite, and other rocks of the Gympie formation, cemented in a grit of quartz, felspar, hornblende, and mica grains, overlaid by a white tenaceous, horizontally bedded, clayey sand. This latter deposit is often 10-15 feet in thickness, and rests on a horizontal floor of granite. This wash averages gold to the amount of 1 oz. 11 dwts. 18 grs. per ton, and the cost for crushing is 12s. 6d. per ton, as against £1 per quartz. Much useless material has to be crushed, owing to the hardness of the cement. The gold occurs in rounded or flattened water worn grains, and is all obtained from the lowest 2 or 3 inches of wash, and the uppermost 2 or 3 inches of decomposed granite floor. A full account of the geology will be found in No. 126 of the Geological Survey publications.

## VIRCHOW'S LECTURE

As the *Saturday Review* reminds us, the selection of Professor Virchow as this year's Huxley lecturer was a quaint method of doing honour to Huxley's memory. The lecture itself was a brilliant statement of the growth of the cellular views of pathology and their influence on medical work,—an eminently suitable subject with which to associate Huxley's name. Virchow sketched the growth of theories regarding vitalism and the gradual development of the cellular theory. He insisted in its corollary that the organism is not an individual but a social mechanism. He referred to the application of the cellular theory to pathology due to his own work, which was an indirect outcome of the biological principle *omnis cellula e cellula*. This principle also explains heredity, while it overthrows some of the most elaborately constructed theories as to the hereditary nature of some diseases. Modern theories of malaria, anti-septic surgery and artificial immunization against diseases are also consequences of the theory of cellular pathology. In the early part of the lecture Virchow paid a warm tribute to Huxley, admiration for whom he said "is deeply rooted within me." But later on there came an unnecessary reminder of former controversy by the remark that "Huxley had no hesitation in filling the gaps which Darwin had left in his argument," and by a reservation that "whatever opinion one may hold as to the origin of mankind," so that Virchow now, as in 1895, is still opposed to the application of evolution to man.

I

The probable depths of the Gault Sea as indicated  
by its Rhizopodal Fauna

WHEN we consider the evidences of variability in the forms of foraminifera, and their power of adaptation to limited amounts of change in their environment, it may seem futile to attempt to attach much value to these organisms, as indices of the bathymetrical and other conditions of the deposit in which they are found. Whilst recognising this power of adaptation, however, we must not lose sight of the fact that marked changes are visible in the aspect of assemblages of foraminifera. For example, when we pass from material which has been laid down in clear and deep water in proximity to limestone cliffs, to other, and it may be, adjacent, and contemporary deposits, subjected to inroads of muddy and decomposing organic material, we shall probably find that, whereas in the former case the species are well-developed and thick-shelled, in the latter case the foraminifera will be thin-shelled and starved, or perhaps with tests formed, of necessity, of the minute sand-grains of the deposit upon which they lived. A case in point is afforded by the limestones and black clays of the Rhaetic of Wedmore Hill in Somerset (1).

The copious records of foraminifera from known depths, made by the Challenger and many other important dredging and sounding cruises, supply us with a tangible basis for the comparison of types of foraminifera which are found in both recent and fossil accumulations.

In consequence of the nature of the sea bottom, its temperature and depth being to some extent interdependent, we may gather many interesting facts by a due consideration of all these points.

In the present instance those species from each zone of the Gault (2) have been taken, which occur also in recent deposits, where their known depths have been accurately recorded. These depths have been carefully averaged for each species selected, and the total mean depth for all the species in each distinct zone of the Gault has been taken as the probable depth of its sea bottom. In cases where there is a preponderance of common and well-developed forms, the evidence of such is considered, to the subordination of occasional examples, which may have been introduced into the

deposit by the action of currents. In obtaining the data from the recent species attention has been especially paid to evidence of depth at which the particular species occurs most frequently, and where it attains its best development.

The material on which these calculations are based cannot afford a complete comparison on account of the number of Gault forms which are quite unknown in recent deposits, but this notwithstanding, an approximation to the truth may perhaps be obtained.

The noteworthy and important groups of foraminifera found in the Gault, and which are not exactly represented in our recent faunas are—

- (1) The strongly costate *Nodosariae*;
- (2) The complanate and limbate *Froniculariae*;
- (3) The sulcated and limbate *Vaginulinae*;
- (4) The remarkably developed and attached *Ramulinae*, the allied genus *Vitriwebbina*;
- (5) And the limbate, reticulate, and spinose *Pulvulininae*.

The comparatively large size and redundant growth of these forms indicates favourable conditions for development, in which a high bottom temperature and a sufficiency of calcareous material dissolved in the water would form important factors. Another possibly important condition was the accumulation of marine shells over which this part of the Benthos of the Gault Sea was able to wander, and amongst which it could shelter. In the case of the *Ramulinae* and *Vitriwebbinae* these curious recent organisms attached themselves to the shells of the mollusca.

Although marked changes are observable in the character of the deposits forming the Gault series in Kent, where they consist of green-sands, clays, and marls, it is somewhat remarkable that the actual rhizopodal fauna does not greatly vary; and so far as one can judge from the results now before us, the depths were not subject to so much oscillation as the lithological character of the beds might at first sight seem to demand. They are all more or less comparable with deposits forming in the moderately deep seas of the present day: they are probably represented by the green, blue, and red muds and the green-sands for the Lower Gault; and by the semi-pelagic or terrigeno-*globigerina* ooze (the meeting ground of the terrigenous and the pelagic deposits) for the marls of the Upper Gault.

In connection with the subject it may be remarked that some years ago Professor T. Rupert Jones stated, in a note on an annelid bed at Westwell Leacon (3) that his colleague, Professor W. Kitchin Parker, believed the Gault Sea to have been 100 fathoms.

F. G. Hilton Price believes the Gault Sea not to have exceeded 100 fathoms in depth, and probably much shallower (4).

In his book "The building of the British Isles" (5), A. J. Jukes-Browne says with regard to this question, "The clays of the Lower Gault seem to have been deposited in a shallow sea of 50 to 70 fathoms deep, which is about the depth of the sea between England and Ireland, while the fossils of the Upper Gault of Folkestone indicate a depth of 100 fathoms and upwards." From the foraminiferal data for each zone of the Folkestone Gault to be referred to subsequently, we obtain a mean depth for the Lower Gault (Zones I.-VII. of Price) of 830 fathoms. In a similar way the Upper Gault (Zones IX.-XIII.) gives a mean depth of 866 fathoms.

The following are the zones with their separate results and points of interest:—

*Zone I. The Green-sand seam at the base of the Gault.*—This is a dark-coloured argillaceous green-sand. The included fossils are much rolled and worn, and this particular deposit appears to have been subjected to the prolonged action of currents. The depth obtained by the evidence of the foraminifera of this bed appears somewhat great, but can be accounted for by the fact of there being a later foraminiferal fauna present, besides the assemblage of glauconite casts. This mixed fauna also appears again in Zone XII. of the Gault (formerly referred to as Zone XI. green-sand seam).

For Zone I. basal bed a possible depth of 750 fathoms is obtained.

At this horizon a single example of *Hormosina globulifera* was found, and although usually occurring at greater depths, it is interesting to note that Dr Goës records it from a depth nearly corresponding with the determination given above.

The samples of green-sand collected during the voyage of the 'Challenger' were taken from depths less than 900 fathoms, the average being 449 fathoms. With regard to the hydrographical distribution of green muds and sands, Messrs Murray and Renard observe in the volume on "Deep Sea Deposits," p. 240, that they "would appear to form an interrupted band along many continental shores at the upper edge of the continental slope."

The usual sequence of the shallow to the deeper parts of the areas occupied by terrigenous deposits is in the order of green-sand (where conditions for its formation are favourable), green mud and blue mud. In the case of the Gault this was followed by a semi-pelagic deposit forming the grey marls of the Upper Gault.

From the samples of green-sand obtained by the 'Challenger,' one may refer, for comparison, to the green-sand, Station IV., between Cape St Vincent and Gibraltar, depth 600 fathoms.

*Zone I. 5 feet above the base.*—A dark clay, greenish when wet, bluish when dry.

This is probably equivalent to the modern fine glauconitic muds.

In this clay there is a fair quantity of minute glauconite grains, found only in the finest washings. The foraminifera yield evidence of slightly shallower conditions than the preceding, which, however, is probably placed at too great an estimation, since the foraminifera obtained from the green-sand seam, as previously pointed out, are not numerous enough to be representative.

The depth for this deposit is 700 fathoms. For comparison, one may refer, as a typical green mud of similar depth, to 'Challenger,' Station No. 163 F., off Sydney, depth 650 fathoms.

*Zone II.*—The samples taken from this zone were clays of a dark green colour.

The residua yielded a fair quantity of glauconite, and the presumably pelagic *Globigerina cretacea* was met with in some frequency. In their general character these clays are comparable with the green muds.

The depth of these samples works out at 820 fathoms.

*Zone III.*—The clay of this zone is of a pale brown or fawn colour, and is quite distinct in appearance from the rest of the Gault. Glauconite is extremely rare, and appears to be entirely absent in the modern red muds, with which this clay may perhaps be compared. The comparison, however, is not much more than one of similarity of colouration in its present condition, for much of the colour in modern red muds is due to ochreous matter, whilst that of the Gault of this zone is due to carbonate of iron with some ochreous staining. It is, however, not very probable that it could have originally been a blue mud, since this would have resulted, as with some other samples of the Gault, in the infilling of the foraminiferal shells with pyrites instead of carbonate of iron, of which we here have evidence. This carbonate of iron is found in some quantity disseminated through the clay as minute casts of organisms; and there are also concretionary bands of the same material running through the bed. This concretionary iron band is perforated throughout with what are apparently annelid borings, and this has been noticed by Mr Hilton Price (5), who drew attention to it in 1876 in connection with a similar annelid bed which Professor Rupert Jones had described (3) from Westwell Leacon in Kent, and locally known as 'Harper.' This bed Professor Jones found in the "upper part of the lowest third of the Gault" at that locality; and he compared it with a bluish-grey mud with annelids found forty miles S.E. of No-Sima Lighthouse, Japan, at a depth of 1875 fathoms. Professor Jones has been good enough to give me a specimen of the annelid rock from Westwell Leacon, and I find it comparable with a similar bed which I found some years ago in the Gault at Godstone. All three specimens probably occur at about the same horizon of the Gault and are equivalent to Zone III. at

Folkestone. The specimens from Westwell Leacon and Godstone are still clays, with no colouration, the tubular infillings being bluish grey, whilst the Folkestone specimen is a clay ironstone.

It is noteworthy of Zone III. at Folkestone, that owing to the absence of pyritous infilling of the foraminiferal shells, they are much paler in colour than is usual with Gault specimens of foraminifera.

The conditions in this zone seem to have been favourable for the crustacea, and by their abundance this bed is known to collectors of fossils as the 'Crab bed.' At this horizon Ostracoda are especially abundant. *Globigerina cretacea* also forms a fairly large proportion of the washings.

From the evidence of the foraminifera, the depth of this deposit was 1180 fathoms.

The character of the clay makes it appear to have been originally a red mud of a semipelagic nature.

*Zone IV.*—The clay of this zone is greenish grey. The foraminifera are very minute, owing to the prevalence of muddy matter, and the scarcity of dissolved calcareous material.

This clay is probably represented in modern deposits by blue mud rather than green mud, since glauconite, although present, is only in a small proportion in the washings.

The depth determined for this zone is 840 fathoms.

*Zone V.*—A grey-blue clay spotted with lighter markings. The washings contained a large proportion of *Globigerina cretacea*, *Sphaeroidina bulloides* also being found.

This deposit seems originally to have been a blue mud, from the quantity of pyrites found infilling the foraminiferal shells and elsewhere, and from the small quantity of glauconite present.

The depth determined by the foraminifera is 750 fathoms.

*Zone VI.*—This is a mottled blue-grey clay. There is much pyritous material as in Zone V. The deposit appears to be equivalent to the blue muds.

The probable depth is 790 fathoms.

*Zone VII.*—A dark blue-green clay, which from the scarcity of glauconite and the presence of pyrites, must have originally been a blue mud. This and the next zone above seems to have been formed under conditions particularly favourable for the existence of the redundantly grown *Pulvinulina spinulifera*.

The depth for this zone is 810 fathoms.

*Zone VIII.*—A grey clay, with a little glauconite in the fine washings. This also can be classed with the blue muds. The ferric carbonate casts become scarcer from Zone III. upward, and are entirely absent in this zone, so far as I have observed, but they again recur in the next and succeeding zones.

The evidence of the foraminifera points to 700 fathoms for the depth of this deposit.

*Zone IX.*—A dark blue-grey marl. *Globigerina cretacea* is found in some abundance, and from thence through the succeeding zones increases in quantity until near the top of the Gault. The deposit, compared with recent accumulations, might be termed a grey terrigenous ooze.

The foraminifera indicate a depth of 910 fathoms.

*Zone X.*—A pale green-grey marl. This zone perhaps more nearly foreshadows conditions which obtained in the Chalk-marl than any of the others. The proportion of calcareous matter is very large (as much as 45%); at 45 ft. from the top—in Zone XI. it was 36%; the Chalk-marl of Eastwear Bay at 10 ft. above the 'Chloritic' marl gave 67½% of calcareous matter. The conditions existent then in Zone X. must have been favourable for calcareous shelled organisms. Here particularly we obtain a great variety of the strong shelled and costate forms of the genera *Nodosaria*, *Fronicularia*, *Marginulina*, and *Vaginulina*; and it was from this zone more especially that the redundant and abnormal forms described in my systematic papers (see Part X. Foraminifera of the Gault of Folkestone) were obtained. This deposit may be classed with those of modern date as a grey terrigenous ooze, and had a probable depth of 900 fathoms.

*Zone XI.*—This bed, measured up to the base of the green-sand seam, is a pale grey marl. *Globigerina cretacea* considerably increases in abundance, and attains its maximum profusion at 45 ft. to 25 ft. below the top of the Gault, as well as in the next zone at 20 ft. from the top.

This bed can be compared with a grey terrigenous ooze, and appears to have been deposited in 870 fathoms.

*Zone XII.*—A glauconite-marl. A noteworthy point about this deposit is that the glauconite casts have been formed at a less depth than that at which the associated foraminifera lived; for the foraminiferal tests seen intermingled with the glauconite casts in the washings undoubtedly belong to a later period than the originals of the casts themselves; these remarks also apply to the microzoic fauna of the green-sand seam of Zone I.

This deposit is to some extent comparable with the glauconite muds, and its depth is indicated as 820 fathoms.

*Zone XIII.*—A pale grey marl, perhaps to be compared with the grey terrigenous oozes of modern deposits.

The foraminifera indicate a depth of 830 fathoms.

It is here necessary to refer to a few points in explanation of the evidence afforded by the foraminifera alone, as regards the depth of sea in which these organisms lived.

It has already been pointed out that those authors who have expressed any opinion as to the depth of the Gault Sea have not given anything like the depths shown by these results based upon a systematic inquiry into the distribution of the foraminifera throughout the Gault at Folkestone (2). Previous authors, with the exception of Professors Parker and Jones,<sup>1</sup> have based their results upon data afforded by a consideration of the groups of the mollusca, crustacea, and other of the larger organisms. These higher groups from modern deposits have, in many cases, only been specially dredged from moderately shallow depths. Although the bathymetrical range of these larger forms is in most cases rather limited to the shallower parts of the ocean, it appears to me extremely probable that current action, of which there is abundant proof throughout the Gault at Folkestone, has there operated in bringing together assemblages of testaceous remains from the higher continental slope on which they flourished, to greater depths where these accumulations took place. It is more reasonable to imagine the removal of the shallow forms to deeper areas than to suppose that the finer muds with foraminifera could be brought into shallower waters.

The presence of phosphatic nodules, so abundant in the Gault, by no means indicates shallow water. That these are due to currents, and by the changes of temperature consequent on their intermingling, has been clearly shown by Murray and Renard ("Deep Sea Deposits," p. 397), who state that phosphatic concretions "may be found in all terrigenous deposits, and also along the edge of the abyssal zone in deposits of a pelagic type, which, however, from their nearness to land, still contain terrigenous elements." These authors also point out (p. 396) "that phosphatic nodules are apparently more abundant in the deposits along coasts where there are great and rapid changes of temperature, arising from the meeting of cold and warm currents, as, for instance, off the Cape of Good Hope and off the eastern coast of North America. It seems highly probable that in these places large numbers of pelagic organisms are frequently killed by these changes of temperature, and may in some instances form a considerable layer of decomposing matter on the bottom of the ocean."

That current action played an important part during the deposition of the Gault is, therefore, not only proved by the numerous lines of phosphatic concretions found at certain intervals, but also by the presence of green-sand seams and scattered glauconite grains found throughout the formations.

The depths here given for each zone of the Gault are merely recorded for what they may be worth; for after all it is a result

<sup>1</sup> Professor Rupert Jones has already expressed to me his belief that the calculation made many years ago by him and his colleague Parker is probably of far less depth than it should be.

obtained from a consideration of only a small proportion of the rhizopodal fauna,—that which is represented in our modern seas.

SUMMARY OF DETAILS RESPECTING THE GAULT AND ITS DEPTHS.

	Horizon.	Nature of Deposit.	Possible Equivalent in Deep-Sea Deposits.	Average Depth in Fathoms.
Zone	I. (Green-sand seam).	Dark argillaceous green-sand.	Green-sand.	750
"	I. (5 ft. above the base).	Dark green clay.	Green mud.	700
"	II.	" " "	" " "	820
"	III.	Pale brown clay.	Red mud.	1180
"	IV.	Green-grey clay.	Blue mud.	840
"	V.	Grey-blue clay.	" "	750
"	VI.	Mottled blue-grey clay.	" "	790
"	VII.	Dark blue-green clay.	" "	810
"	VIII.	Grey clay.	" "	700
"	IX.	Dark blue-grey marl.	Grey terrigenous ooze.	910
"	X.	Pale green-grey marl.	" " "	900
"	XI.	Pale grey marl.	" " "	870
"	XII.	Glauconite marl.	Glauconite mud.	820
"	XIII.	Pale grey marl.	Grey terrigenous ooze.	830

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## II

The Gular Pouch of the Great Bustard (*Otis tarda*)

IN reviewing the history of the gular pouch of the Great Bustard we have of necessity to trace the history of the explanation of two very different phenomena, which at last resolve themselves into complementary halves of a common whole. The first of these deals with the fact now known to all ornithologists, that several different species of Bustard have the power of inflating the neck to an enormous degree, at intervals during that period when, as the poet has it, "fancy, lightly turns to thoughts of love." It is one of the many methods of 'showing off' to be found in such abundance amongst birds. At least three different versions have been given to explain how this inflation is brought about. The second, as already hinted, is linked with that of the first. It concerns what is the main theme of this paper,—the Gular Pouch. The very existence of such a structure has been denied by some, by others it has been held to be a receptacle for water, food, and air. Those who subscribed to this latter view, for the most part connected it more or less definitely, with the curious love displays just referred to, and knew something of the habits of the living birds, which the others did not. The aim of the present paper is to give a sketch of these various conflicting interpretations and to draw attention to one or two minor points around which some doubt still seems to hover.

The earliest known indication of the possession of this faculty of inflating the neck by the Great Bustard dates back as far as 1681. This we owe to Sir Thomas Browne<sup>1</sup>: he remarks that "as a Turkey hath an odde large substance without, so had this [*Otis tarda*] within the inside of the skinne." Here however we have nothing more than a bare statement drawing attention to the fact that the neck of this species of Bustard differed from that of birds generally in this respect, and we are left to imagine that it is a constant character possibly possessed by both sexes in common. Some half century later a real contribution to our knowledge of the subject was made, which was destined to become the subject of much animated discussion. It concerns the gular pouch. This we owe to Dr James Douglas, a British anatomist. The first mention of this was made by Albin in 1740, for Douglas it seems did not

<sup>1</sup> The quotations from the earlier writers are taken for the most part from Professor Newton's valuable article in the *Ibis* for 1862.

announce his discovery during his lifetime. Albin's reference runs as follows: "Dr Douglas has observed in the Male [of the Great Bustard] two Stomachs, one for the Food and the other a Reservatory for Water to supply them, they feeding in dry Heaths remote from Ponds and Rivers." A fuller account was given by Edwards in 1747. This also deals with the discovery of Douglas, and repeats the interpretation originally given, of the use of the pouch as a receptacle for water. "Its capacity," he says, "is full seven Wine Pints." It is further stated to be wanting in the Hen.

M. Gauthier de la Peyronie, in his "*Voyages de Pallas*" (15a) says of the Great Bustard:—"Cet animal a un petit trou sous la langue, qui sert d'ouverture à une bourse aqueuse, qui est de la grosseur d'un oeuf d'oie." That the Great Bustard—and probably also other species—possessed a gular pouch which was used as a receptacle for water seems by this time to have been pretty generally believed. Thus in 1781, Daines Barrington tells us of "a gentleman long resident at Morocco, where they frequently fly their hawks at bustards, hath also informed me that the cock makes use of this reservoir of liquor against these assailants, and commonly thus baffles them." In the following year (1782) Bloch gave an account and figure of this pouch. He remarks: "Bey diesem grossem Vogel \* \* \* siehet man einen Sack unter der Haut am Halse, dessen Oefnung unter der Zunge sichtbar ist. . . . Er ist weit, war bey einem alten Hahn, den ich untersuchte ein Fusslang, und erstreckte sich von der Kehle bis an die Brust." He then goes on to remark, "dass nur die Männchen allein mit diesem Sack versehen wären, so widerspricht diesem meine Erfahrung; denn ich habe ihn auch bey einem Weibchen gefunden." This is the first statement of its occurrence in the female, and one, we may remark, which has never yet been verified.

Naumann in 1834 gives the results of his observations on this subject. After describing the general position of the pouch, and its opening under the tongue, he goes on to remark that "Er hat, wenn er mit Luft oder Wasser angefüllt ist, oft eine einfache, sehr langgezogene Eigestalt; gewöhnlicher noch ist er aber am Eingange enge; dann eiförmig erweitert und in der Mitte seiner Länge am weitesten; nachher wieder sehr verengert; dann wieder in Eiform, aber kürzer und nicht so stark wie oben erweitert und wie ein spitzes Ei geschlossen. . . . Er fasst eine ziemliche Menge Wasser, doch lange keine 8 Pfund, und man vermuthet, wiewohl ohne Grund, er sei ein änlicher Wasserbehälter wie der des Kameels, um Vorrath trinken zu können; aber warum war er denn dem Weibchen nicht auch gegeben?! Wasser fand ich überhaupt darin nur sehr wenig, nicht einmal einen Esslöffel voll, vielmehr ihn meistens ganz leer, nur ein Mal einige Grassamen, welche zufällig

hinein gerathen zu sein schienen. Er scheint mir überhaupt mehr ein Luftals Wasserbehälter zu sein. Sein Zweck bleibt vor der Hand ein Räthsel, wie er dies schon lange war."

John Hunter apparently made a dissection of this pouch. He did not, however, subscribe to the prevalent opinion that it served as a receptacle for water, on the contrary he candidly expresses that he does not know what its use may be. He describes it as "a large bag, as large as the thick part of one's arm: it terminates in a blind pouch below, but has an opening into it at the upper end from the mouth. This aperture will admit three or four fingers<sup>1</sup>; it is under the tongue, and the *fraenum linguae* seems to enter it; and it seems to have a sphincter. What the use of this is I don't know. . . ."

None of the writers so far quoted seem to have connected this pouch with the phenomena of sexual display, probably because they had never witnessed the remarkable evolutions and contortions of this bird during its moments of ecstatic frenzy.

The credit of this interpretation perhaps belongs to Schneider. It seems, however, that he had never examined this pouch for himself, but relied on the accuracy of the observations of those more fortunate who had. Commenting upon Bloch's statement, which evidently much puzzled him, that the pouch was found in both sexes, he says:—"Si mas solus sacco gulari gaudet, potest tum in amore eum forte inflare, ut collum intumescat. Contra si femina eundem habet, quod vix credo, alium tum eidem usum excogitare debemus." It is possible, however, that Schneider is indebted to the Emperor Friedrich the II. for the suggestion that the pouch may be occasionally and voluntarily inflated. Inasmuch as the latter, acquainted only with the external phenomena, drew attention to the "*grossum collum*" possessed by both sexes of the Great Bustard, and especially the males '*tempore coitûs*.'"

Quite another rendering was given as an explanation of this curious inflation of the neck by Degland (4), who writes:—"Je dois à mon honorable confrère, le docteur Dorin, de Châlons-sur-Marne, la connaissance d'un fait assez curieux et que je ne dois pas omettre. A l'époque des amours, il se développe dans le lieu même où s'insèrent les moustaches, une sorte de fanon, formé par une masse de tissu cellulaire grasseux, lâche, dont le volume est considérable, puisqu'il atteint et dépasse le poids d'un kilogramme. Cette sorte de fanon, qui occupe la partie antérieure et latérale du cou, est formée de deux masses qui se réunissent sur la ligne médiane à partir de la naissance des barbes jusqu'au bas du collier. C'est au moyen de muscles fauciers assez développés que l'oiseau peut imprimer des mouvements à cette masse, et par conséquent relever ou abaisser les

<sup>1</sup> The spaced type is mine.

plumes allongées qui s'y implantent. A la fin de juillet, elle commence à s'affaïsser, les plumes tombent, se renouvellent, si bien qu'avant la fin de septembre il ne reste plus rien de cette grande masse de tissu cellulaire." Owen, a year previously, had dissected a specimen, said to have been a male,<sup>1</sup> apparently for this purpose, and found "no trace of a gular pouch," thus so far confirming Degland: Mitchell, Yarrell, and later, Professor Newton, all searched carefully for this pouch, and failed to find it; neither could they discover any opening under the tongue. The latter thus describes his search:—"We cleared the skin away from the entire neck. . . . The neck was entirely clothed with cellular tissues in a most remarkable manner; they were very delicate, and so close to the skin, that even when we grazed the roots of the feathers we occasionally cut them. On the blowpipe being inserted into one of the apertures thus made, a small bubble was immediately raised, which increased on greater power, being applied so as to form a considerable bag, perhaps three inches long, . . . it was plain . . . that none of these bags existed of themselves, but were the result of the membranes being forcibly ruptured by the pressure of the air."

Thus, then, at this time, so far as English ornithologists were concerned, the case for the existence of a gular pouch in the Bustard had fallen through for lack of evidence. There seemed to be no other way of explaining the facts advanced by the older writers than that of supposing the 'pouch' which they saw was artificial, caused by the rupture of cellular tissues. Unless indeed it was, as some suggested possible, present in some individuals, but not in others. That the specimens dissected in England, says Professor Newton (14), "were not all young, undeveloped birds, is also clear; but if any further evidence on this point is required, I would refer to the beautiful picture by Mr Wolf (fig. 1), which was drawn from an individual in our Zoological Gardens,—an individual afterwards the subject of one of the examinations here mentioned, though of which is not certain. No one who looks at that picture . . . can for a moment doubt that the original was a truly adult, mature, and fully developed bird.

Dr Cullen (3), inspired by Professor Newton's article (14), published the results of an examination of two males procured by him in Kustendjie, Bulgaria. In both of these a pouch was found, the largest of which he figured. The "opening under the tongue," he writes, "is large enough to admit readily the little finger, and is surrounded by what has all the appearance of a sphincter-muscle . . . the pouch extended as far down as the furcular bone, enveloped closely throughout by a thin muscular covering exactly analogous in structure to the *cremaster* or *platysma hyoides*. The structure of the sac . . . is certainly not composed of cellular tissue as stated by

<sup>1</sup> Garrod suggested that this was probably a female.

Degland; but . . . is a separate and distinct, though delicate bladder. . . . After describing the very extraordinary evolutions of this bird during periods of display, and the great inflation of the neck with which they are accompanied, he goes to remark that "All these facts would certainly seem to favour the idea that the pouch is intended to contain air, and that by the action of the muscular tissue covering it conjointly with that of the sphincter at the mouth, the Bustard may thereby be assisted . . . in producing the peculiar sound (resembling 'ook'), which is only to be heard during the time when the pouch is most developed. . . ."

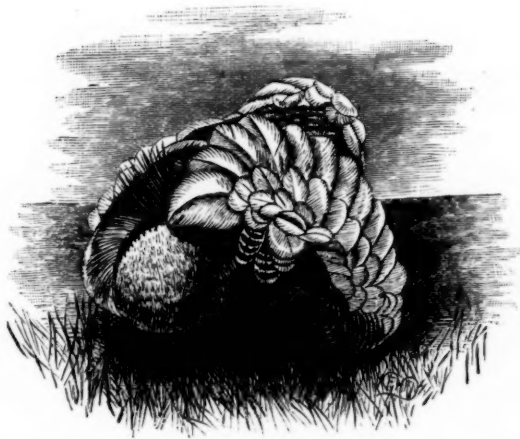


FIG. 1.—The display of the Great Bustard, *Otis tarda* (after Wolf).  
From Newton's "Dict. of Birds."

These two preparations afterwards came into the possession of the Royal College of Surgeons, and were described by Sir William Flower (6). The larger of the two sacs when empty measured nine inches in length, and when moderately distended with water was found to hold three imperial pints.

"Both of the sacks," he writes, "had within them a few short pieces of grass and leaves. There appears to be no glandular structures connected with the walls; indeed, the whole character of the sack points to its being a simple reservoir, probably for fluid, more analogous to the submandibular pouch of the Pelican than to anything else in the class Aves. But in the absence of fuller information as to the economy and habits of the bird, I refrain from speculating upon the purpose of this singular and apparently inconstant organ."

With Dr Cullen's investigations and their confirmation by Professor Flower the existence of a pouch at least in some individuals was placed beyond cavil.

In 1868 Dr Murie, then Prosector of the Zoological Society, published his "Observations on the presence and function of the Gular Pouch in *Otis kori* and *Otis australis*." His remarks concerning the former were based upon the examination of a specimen which had recently died in the Gardens. In this, a distinct opening was found under the tongue leading into a small pouch "three inches in length and about an inch in transverse diameter." As touching the latter, his observations were based entirely on a bird then living in the Society's Gardens. Of this he writes that he was pleased to find what he thinks "may be termed an exaggerated example of this organ in the Australian Bustard." He continues: "This 'showing off' which is . . . a most extraordinary sight, may best be comprehended by a study of the accompanying sketch (fig. 2) drawn from nature during one of those paroxysmal periods of excitement."



FIG. 2.—The display of the Australian Bustard, *Eupodotis* [*Otis*] *australis* (after Murie).  
[This block was reproduced from a photograph of a coloured lithograph, and is unfortunately not very clear.]

"The premonitory symptoms observable when the Bustard is about to exhibit himself in the pride of lust . . . is a slight swelling of the inframandibular portion of the throat, while the head is thrown upwards. Immediately afterwards the neck swells and the feathers of the lower parts concomitantly bulge out and descend gradually downwards in the form of a bag, oftentimes nearly reaching the ground.

"If the paroxysm is a strong one, then the tail is shot upwards and forwards over the back, the rectrices coming almost in contact with the neck.

"In this peculiar attitude, with bloated neck, hanging baggy chest, elevated tail, and stiff stilt-like legs, the creature struts about in a somewhat waddling manner, the elongated pouch swaying to and fro.<sup>1</sup> The feathers of the throat start out on end; those of



FIG. 3.—The oesophagus, trachea, and gular pouch of a specimen of *Otis tarda*, seen from the side. The crop is here drawn as in the actual preparation, projecting backwards, and not forwards as usual. (After Garrod.)

the depending sac are also raised, but less upright. While all this has taken place the bird seems to have gulped in air, or rather, with partly opened gape, to have taken a long, deep and forced inspiration.

"The acme of inspiratory effort and strange attitude attained, the Bustard begins to snap the mandibles together in a loud manner and utter a series of cooing sounds for a short interval of time. Usually and more frequently he struts towards the female Bustards in a most dignified manner, or oblivious as to sex, totters up to any of the birds in the same enclosure."

Some years later (in 1873) the mouth of this identical Bustard was examined by Professor Garrod,—Dr Murie's successor to the Prosectorship,—with a view to finding a sublingual orifice such as obtains in *O. tarda*. There was no trace of any such orifice. This

<sup>1</sup> The spaced type is mine.

led Garrod "to doubt the correctness of Dr Murie's inference, that because the neck of *Eupodotis australis* becomes distended much during the sexual season, therefore there is a gular pouch." The next year this bird died and was dissected by Garrod. As a result, "there was no gular pouch. There was no sublingual orifice. . . . How unsafe therefore is it to infer that because the neck distends and depends during the 'show-off,' there must be a sublingual pouch. It is quite possible that two effects, very similar in appearance, in closely allied birds, may be the result of different mechanisms." A careful investigation showed that the cause of the inflation of the



FIG. 4.—The oesophagus and trachea of the specimen *Eupodotis australis* here described. The oesophagus is much dilated, and, like that of the Pouter Pigeon, can be distended with air by the living bird. No trace of a pouch or crop is to be seen (after Garrod).

neck in this case was due to a highly extensible oesophagus. "Before dissection, by filling its cavity with air, the lower portion of the dilated oesophagus protruded downwards considerably in front of the *symphysis furculae*, and formed the depending portion of the sac which was so conspicuous in the living animal." The two woodcuts (figs. 3 and 4) kindly lent by Mr Sclater for the present paper, are taken from Garrod's original paper.

Fig. 5 represents a dissection which the writer has just made of the gular pouch of an adult male till recently living in the Gardens of the Zoological Society; and which will shortly be exhibited in

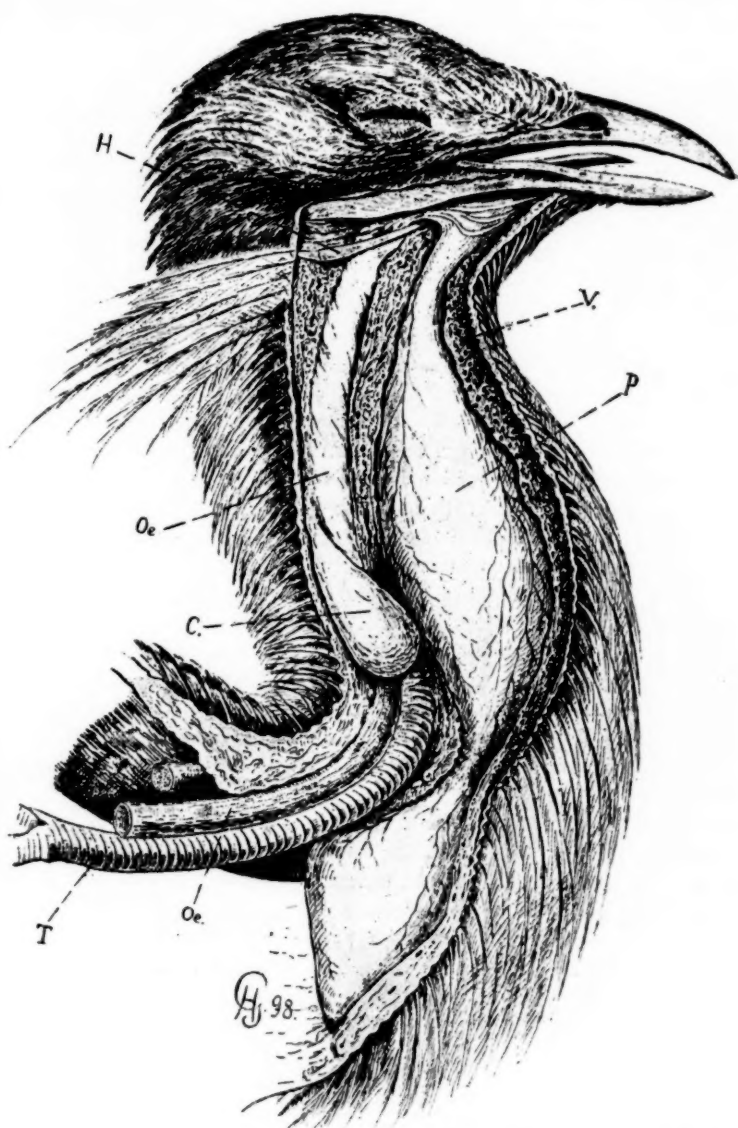


FIG. 5.—Dissection of the right side of the neck of the Great Bustard, *Otis tarda*, to show the hour-glass-shaped gular pouch. [Drawn by H. Grönvold from the specimen in the British Museum.] C. Crop; H. Hyoid; Oe. Oesophagus; P. Pouch; T. Trachea; V. Vascular tissue, investing the upper part of the pouch.

the Bird Gallery of the British Museum (Natural History). There is no need to describe in detail its form, capacity, and so forth; particulars of this kind will have been gathered already from the preceding pages. I might, however, remark that the sublingual aperture in my specimen was not  $\perp$ -shaped but circular showing a hole large enough to admit the finger. Possibly this was due to relaxation of the muscles. After removal of the head and neck, the pouch was filled with spirit till it overflowed, the whole was then plunged into 70 per cent. spirit and left for some days. It was then taken out, and the skin from one side removed (fig. 5). Underlying was a mass of fatty tissue more or less completely investing the pouch. Along the anterior aspect of the neck, from the throat downwards, this is engorged with blood. The pouch was loosely attached to this investiture by delicate strands of fibrous tissue. The constriction in this pouch probably corresponds with that described by Naumann, and occurs at the lower part of the neck where it bends between the furcula, between the arms of which the expanded terminal portion is received.

In conclusion I would point out:—(1) That the characteristic 'show-off' of the adult male *Otis tarda* ever takes place without the aid of a gular pouch, is exceedingly improbable. But that this pouch is present throughout the year is another question, and is a point which has yet to be settled. It was not found in the specimen from which Wolf's beautiful drawing was taken, nor in numerous other cases in which it was carefully searched for. In the specimen lately dissected by myself, it was, as is shown in the illustration (fig. 5), very large. But this bird died in May, in the middle of its period of functional activity; (2) There is no evidence to show that it is ever present in the female; (3) The belief that this sac is ever used as a receptacle for water must now be regarded as utterly exploded; (4) It is not homologous with the 'air-sacks' proper, belonging neither to the pulmonary nor to the naso-pharyngeal system. *Biziura lobata* seems to be the only other bird besides the Bustards possessing a precisely similar structure.

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III

An Existing Ground-Sloth in Patagonia<sup>1</sup>

MANY times I have heard allusions to a mysterious quadruped which is said to exist in the interior of the territory of Santa Cruz, living in burrows hollowed out in the soil, and usually only coming out at night. According to the reports of the Indians, it is a strange creature, with long claws and a terrifying appearance, impossible to kill because it has a body impenetrable alike to fire-arms and missiles.

It is several years since the late Ramon Lista, a traveller and geographer well known to the world of science, told both myself, my brother Charles, and several other persons—and had, I believe, even printed the statement in one of his works—that he had seen the mysterious quadruped in question. He came across it one day during one of his journeys in the interior of the territory of Santa Cruz, but in spite of all his efforts he was unable to capture it. Several shots failed to stop the animal, which soon disappeared in the brushwood; all search for its recovery being useless.

Lista retained a perfect recollection of the impression this encounter made upon him. According to him the animal was a pangolin (*Manis*), almost the same as the Indian one, both in size and in general aspect, except that in place of scales, it showed the body to be covered with a reddish grey hair. He was sure that if it were not a pangolin, it was certainly an edentate nearly allied to it.

In spite of the authority of Lista, who, besides being a learned traveller, was also a skilled observer, I have always considered that he was mistaken, the victim of an illusion. Still, although I have several times tried to find out what animal might have given him the illusion of the pangolin, I was never able to guess.

It was not an illusion. Although extremely rare and almost extinct, the mysterious animal exists, with the sole difference, that instead of being a pangolin, it is the last representative of a group

<sup>1</sup> Translated from a pamphlet entitled "Première Notice sur le *Neomylodon listai*, un Représentant vivant des anciens Edentés Gravigrades fossiles de l'Argentine," by Florentino Ameghino, separately published by the author in the city of La Plata, Argentine Republic, August 1898. We have already noticed this important discovery (p. 288), but it is one of so much interest to zoologists that no apology is needed for directing further attention to the subject by reproducing the complete article.

which was believed to be quite extinct, a gravigrade edentate related to *Mylodon* and *Pseudolestodon*.

The gravigrade edentates are reckoned among the oldest mammals which appeared upon the earth. The most ancient traces of them have been observed below the Guaranian Formation, with gigantic Dinosaurs, in the variegated sandstones of Patagonia, which are referred to the Lower Cretaceous. They become more numerous in the *Pyrotherium* beds of the Guaranian, develop gradually, and attain their greatest diversity during the Upper Eocene (Santa Cruz Formation). Thenceforward their variety decreases, but their size gradually increases, until in the Pampean they are represented by a certain number of gigantic forms, such as *Megatherium*, *Lestodon*, *Mylodon*, etc. Rare fragments in a bad state of preservation have been found even in the Post-Pampean deposits, but no one had supposed that they still had living representatives.

Some of the Pampean genera show a very curious character: the body was protected on all sides by an incredible number of small irregular ossicles, which it is supposed were developed in the thickness of the skin, and thus became covered with a horny or scaly epidermis. The genera showing this peculiarity are *Mylodon*, *Pseudolestodon*, and *Glossotherium*. The other genera, such as *Megatherium*, *Lestodon*, and *Scelidotherium*, do not show any trace of it. Besides in the Pampean Formation these ossicles are met with in the Araucanian Formation of Monte Hermoso and Catamarca, and also in the Entrerios Formation; but no trace of them has been found in the Santacruzian, where the gravigrade edentates are so abundant, or in the earlier formations. We conclude from this that the character in question is not primitive, but acquired secondarily at a relatively modern period.

These ossicles, comparable to large coffee berries, differ slightly in shape and size according to the genera. In *Glossotherium* they are large and flattened; in *Mylodon* they are smaller, irregular, elliptical, trapezoidal, or rhomboidal, with one side more convex or keeled, their diameter varying from one to two centimetres, though sometimes less. Their surface, more especially on the flattest side, shows some tiny depressions and perforations, and reticular tracery well seen under the magnifying glass. Their aspect is so characteristic that when one has once seen them they are recognised immediately without any danger of being mistaken.

Lately, several little ossicles have been brought to me from Southern Patagonia, and I have been asked to what animal they could belong. What was my surprise on seeing in my hand these ossicles in a fresh state, and, notwithstanding that, absolutely similar to the fossil dermal ossicles of the genus *Mylodon*, except only that they are of smaller size, varying from 9 to 13 or 14 mm.

across. I have carefully studied these little bones from every point of view without being able to discern any essential difference from those found in a fossil state.

These ossicles were taken from a skin which was unfortunately incomplete, and without any trace of the extremities. The skin, which was found on the surface of the ground, and showed signs of being exposed for several months to the action of the air, is in part discoloured. It has a thickness of about 2 centimetres, and is so tough that it is necessary to employ an axe or a saw in order to cut it. The thickest part of the skin is filled by the little ossicles referred to, pressed one against the other, presenting on the inner surface of the skin an arrangement similar to the pavement of a street. The exterior surface shows a continuous epidermis, not scaly, covered with coarse hair, hard and stiff, having a length of 4 to 5 centimetres and a reddish tint turning towards grey.

The skin indeed belongs to the pangolin which Lista saw living. This unfortunate traveller lost his life, like Crévaux, in his attempt to explore the Pilcomayo, and until the present time he is the only civilised person who has seen the mysterious edentate of Southern Patagonia alive; and to attach his name appropriately to the discovery, I call this surviving representative of the family *Mylodontidae* *Neomylodon listai*.

Now that there are certain proofs of its existence, we hope that the hunt for it will not be delayed, and that before long we may be able to present to the scientific world a detailed description of this last representative of a group which has of old played a preponderating part in the terrestrial faunas which have succeeded each other on South American soil.

FLORENTINO AMEGHINO.

## IV

## The Imperfection of the Geological Record

IT is now many years since Darwin first directed the special attention of biologists to the imperfection of the geological record. It was he who first satisfactorily marshalled the facts which prove that the discoverable fossils in the rocks can only give a very limited idea of the plants and animals which have tenanted the globe at different periods in its past history. He pointed out how small a portion of the earth had been geologically explored, and how small a percentage of known types of life had sufficient hard parts to be preserved in a fossilised state. He emphasised the fact that the number both of specimens and of species preserved in our museums, is absolutely as nothing compared with the number of generations which must have passed away even during a single geological formation. He also observed "that, owing to subsidence being almost necessary for the accumulation of deposits rich in fossil species of many kinds, and thick enough to outlast future degradation, great intervals of time must have elapsed between most of our successive formations; that there has probably been more extinction during the periods of subsidence, and more variation during the periods of elevation, and during the latter the record will have been least perfectly kept; that each single formation has not been continuously deposited"; that, indeed, in every area of the earth's surface there are incalculable periods of geological time unrepresented in the records of the rocks.

We may, in fact, without exaggeration declare that every item of knowledge we possess concerning extinct plants and animals depends upon a chapter of accidents. Firstly, the organism must find its way into water where sediment is being deposited and there escape all the dangers of being eaten; or it must be accidentally entombed in blown sand or a volcanic accumulation on land. Secondly, this sediment, if it eventually happens to enter into the composition of a land area, must escape the all-prevalent denudation (or destruction and removal by atmospheric and aqueous agencies) continually in progress. Thirdly, the skeleton of the buried organism must resist the solvent action of any waters which may percolate through the rock. Lastly, man must accidentally excavate at the precise spot where entombment took place, and someone must be at hand,

capable of appreciating the fossil and preserving it for study when discovered.

The importance of remembering these considerations when speculating on biological subjects has recently been illustrated once more by the discovery of a new Upper Silurian fish-fauna in the south of Scotland. As already mentioned in *Natural Science* (vol. xiii., p. 157) this remarkable assemblage of fishes or fish-like organisms has been found by the Geological Survey at the top of the Silurian formations of Lanarkshire; and some preliminary notes by Dr Traquair announce that a complete memoir on the subject will shortly appear. Now, scattered and abraded fragments of similar organisms have been known for nearly sixty years in a thin stratum, termed the Ludlow Bone-bed, in the Upper Silurian of Herefordshire and adjoining counties. Fossils of the same kind have been collected for nearly half a century in an Upper Silurian limestone in the island of Oesel, in the Baltic Sea. Traces of them also occur in Galicia, Pennsylvania, and New Brunswick; and a few years ago similar fragments were sent to me by the Geological Survey of Canada from another locality in Newfoundland. However, notwithstanding this proof of the very wide distribution of the late Silurian fish-fauna in question, we have had to wait for the accidental discovery of a thin stratum in Lanarkshire to obtain even a faint idea of the strange types of life represented by the familiar scales and other exoskeletal fragments.

Although it is now nearly forty years since Darwin's "Origin of Species" first appeared, his lament at the hopelessness of testing all the principles of organic evolution by reference to the "records of the rocks" might indeed be appropriately renewed at the present day. The discovery of new fossils in all parts of the world has progressed at an astounding rate in the interval; and we are beginning to perceive feebly some of the laws which govern their succession and distribution. The biologist who is prone to glance through palaeontological text-books, however, and utilise them in his speculations, cannot be too frequently warned of the imperfection of our knowledge and the danger of trusting to negative evidence.

To understand the importance of this warning at the end of nineteenth-century science, it is only necessary to consider the case of some of the most striking and philosophically valuable vertebrate animals.

Firstly, there is the remarkably early Devonian organism *Palaeospondylus gunni*, frequently referred to in these pages. Whether it is a primaeval lamprey or not, it is the single known representative of its group, and implies the former existence of a great race of which we are acquainted with no other member. This fossil occurs in the Caithness flagstones, which were deposited in a

lake in the Devonian or Old Red Sandstone period, and have been worked for commercial purposes from time immemorial. Fossil fishes have been known and collected from them for more than seventy years. Every exposure has been searched by expert collectors, whether in the cliffs or in quarries. Yet, *Palaeospondylus* has only been found in one very thin stratum in a single quarry, where it occurs, not as a rarity, but in countless numbers. It seems as if a shoal of the species had been accidentally destroyed and suddenly covered up; and it is a fortunate accident that a small quarry has been opened at the precise spot.

Our knowledge of the earliest shark-like fishes exhibiting the most primitive type of paired fins is almost equally scanty. *Cladoslache*, in a state fit for accurate scientific study, has hitherto been met with only in a flagstone at the base of the Carboniferous formations in Ohio, U.S.A. Teeth of the same kind have been known for many years from several parts of the northern hemisphere; but the complete fish has only been discovered in Ohio within the last decade, and even now the skeleton of the head and vertebral axis remains practically unknown.

In some instances the old Palaeozoic forms of fish-life which withdrew to the comparatively peaceful realms of rivers and fresh-water lakes after the vigorous period of their race was past, and survived until the present day, were thus entirely lost to geological records. For example, three detached teeth from the English oolites and scarcely more from corresponding rocks in Colorado, are the sole known traces of the Dipnoan fishes between their world-wide distribution at the dawn of the Mesozoic era and the scattered remnants which still survive in the fresh-waters of South America, Africa, and Queensland. Similarly, there is no doubt that *Polypterus* and *Calamoichthys* existing in the fresh-waters of tropical Africa, are the direct and little-altered descendants of some of the Palaeozoic fringe-finned ganoids; but we have still not found even a trace of them in the Mesozoic or Tertiary strata in any part of the world. They must have lived somewhere, but the geological record, so far as explored, is too imperfect to afford a clue to their whereabouts and history.

The case of the Amphibia or Batrachia is still more remarkable; though perhaps they, too, have been fresh-water animals since the Palaeozoic era. It is definitely proved that some of the early lung-breathers belonged to this class; for traces of gill-arches are occasionally observed in young individuals, showing that they breathed by gills in their immature state (*Branchiosaurus*, *Archegosaurus*). It is also certain that these primitive Amphibia were the dominant type of vertebrate life from their appearance until the middle part of the Permian period. In early Mesozoic times, however, they suddenly

disappear from the records of the rocks; and practically nothing is known of them until the early Tertiaries, when the various genera and families are almost identical with those surviving at the present day. The only satisfactory specimen of intermediate date is a solitary skeleton (*Hylaeobatrachus*) from the Wealden of Bernissart, Belgium, which seems to represent an animal with persistent gills related to the existing *Proteus* and *Menobranchus*.

The story of the early mammals is almost similar. In rocks dating back to the close of the Palaeozoic and the dawn of the Mesozoic period, there are abundant remains of the Anomodont reptiles or Theromora, which make an extremely close approach in their skeleton to the warm-blooded quadrupeds which we term mammals. They are found in South Africa, India, Russia, Switzerland, Scotland, North America, and South America. They must thus have been almost world-wide in their distribution. It is also clear that many of them attained a very large size. In all the regions mentioned, however, they completely disappear above the Trias; and the only known Mesozoic fossils which can be referred to the Mammalia are some fragments of animals no larger than rats from the Jurassic of England and the Jurassic and Cretaceous of North America. It seems, indeed, as if the mammals were evolved in some region of the southern hemisphere which is either now submerged or not yet geologically explored; for they suddenly appear in great numbers and variety at the base of the Eocene Tertiary both in Europe and North America, which must be the result of migration on the re-arrangement of land and sea. It is very curious that notwithstanding the numerous examinations of the Mesozoic and Tertiary strata of Australasia and South America during the last half-century, not a single clue to the solution of the problem has hitherto been obtained. As suggested by Mr Lydekker in a recent issue of the *Transactions* of the Geological Society of South Africa, it is extremely probable that we must turn to a geological exploration of the Dark Continent for the next important advance in our knowledge of the subject.

Our ignorance of the early land-mammals is strange, but the want of all knowledge of the ancestors of the marine mammals—whales, porpoises, and sea-cows—is still stranger. It is well known that at present all the great Mesozoic marine reptiles of the orders Ichthyosauria, Plesiosauria, and Mosasauria or Pythonomorpha, seem to disappear suddenly at the top of the Cretaceous formations; while the marine mammals of the orders Cetacea and Sirenia take their place as suddenly towards the top of the Eocene strata. This happens not only in Europe and North America, but also in Australasia, perhaps likewise in South America. Now, we are well acquainted with marine deposits, both of littoral and deep water origin, of intermediate age in many parts of the world.

Presumably, therefore, if the marine mammals are derived from terrestrial quadrupeds, as seems probable, we ought to find fossil records of their partially evolved ancestors in some of these deposits. As a matter of fact, we have hitherto found nothing. The earliest known Cetaceans and Sirenians are more nearly like normal land-mammals than the later and existing genera of the same orders; but the approximation is only very slight. They are completely differentiated on their earliest appearance, and the geological record, so far as explored, affords no clue whatever to their origin and affinities. It is, of course, possible that these aquatic animals originated during the Mesozoic period in some land-locked sheet of water or lake, of which the sediments have been destroyed or not yet discovered. Some American palaeontologists think it very probable that the seals originated in this way at an early Tertiary period in North America, where there were already great lakes. It may therefore be that the history of the other marine mammals is similar.

Not only is our ignorance deep and absolute in respect to many of these most fundamental problems: it also progresses very slowly even in some instances where enlightenment begins. Consider the case of the ancestral birds. Of the all-important *Archaeopteryx* we still have only two good specimens from one formation and locality; and we know nothing more of the great race to which it belongs. Of the Cretaceous toothed birds, which have now been known for more than a quarter of a century, the only satisfactory specimens hitherto discovered are a few from one formation in one region of North America.

Again, our knowledge of the history of the elephants has scarcely progressed (except in minute details) since Falconer left the subject at the time when Darwin first referred to it. They can be traced back to a certain point in the Miocene period, where *Dinotherium* seems to be an ancestor of the order in the Old World; but there our genealogy stops. Of *Dinotherium* itself we know very little accurately beyond the teeth; while of its origin and ancestry we can still not recognise a trace among the mammals of earlier date.

Within the last quarter of a century enormous progress has indeed been made in discovering links in the chain of life and in determining the facts of distribution at different periods. The working out of the Tertiary mammals in North America, for example, has opened up a new era in Biology and Geology. But most of the animals discovered and named are known only by a few fragments, which do not reveal even a tolerably complete skeleton. There is very little material for detailed comparison; and only in a few instances is it possible to study individual and local variations. There are very few even of the best known species

of fossil vertebrates which could be described in ample detail, without any assumptions based on the theoretical association of fragments.

Another point worth remembering is this. At the present time all the groups of organisms which are at or near the culmination of their race—are, in fact, dominant types—are represented by numerous genera and almost innumerable species. It is only necessary to think for a moment of such characteristically modern groups as the herring-like fishes, the lizards, the perching birds, and the rats and mice. When, however, we turn to lists of fossils, especially of vertebrate fossils, we note conspicuous poverty in the number of genera and species representing each group even at the period of its maximum development. The reason is not to be sought in the diffidence of palaeontologists to emphasise variations by the multiplication of names: it is solely this, that the geological record preserves only an insignificant proportion of the organisms which have lived even under the most favourable circumstances for burial after death.

A. SMITH WOODWARD.

## V

## Artificial Formation of a Rudimentary Nervous System

IN my work "L'origine des individus et la construction de l'organisme par les conditions internes"<sup>1</sup> I put forth a mechanical theory of organisation according to which the internal order of beings and their embryological evolution was supposed to be the result of nutritive conditions solely. I admitted the principles regarding inheritance as a consequence of present causes proposed by Delage, and supported his statement with many arguments, but I have of late been induced to consider the whole question from a rather different point of view. There are, in my opinion, no germinative plasma and no mysterious principles in the pronucleus, the composition of which cannot have been modified by the mutilations endured by certain organs of its progenitors. The Monads, the Protists of early geological times, evolved into superior mammals without their having any tendency, marvellous property, germinative plasma or catalytic excitants of glandular origin within themselves.

The internal and external conditions, that is, the agents of progress in the mechanism of nourishment, have doubtless been the efficient causes of an evolution still more astonishing than that of human ovules. Moreover, the study of cellular genealogy, grafts, regeneration, monsters and atavisms obtained by a diminution of nutrition, etc., has demonstrated that there is naught but mechanism more or less obscure and complicated. But the supreme question concerning the origin and functions of the nervous system will be forever a source of impossibilities and embarrassment.

I. There are no essential differences in the vibrations of more or less viscous liquids be they organic or inorganic, for instance: gelatine with glycerine, *Limax* mucus dissolved in acetic acid, albumen of egg, water, mercury or neuroplasm.

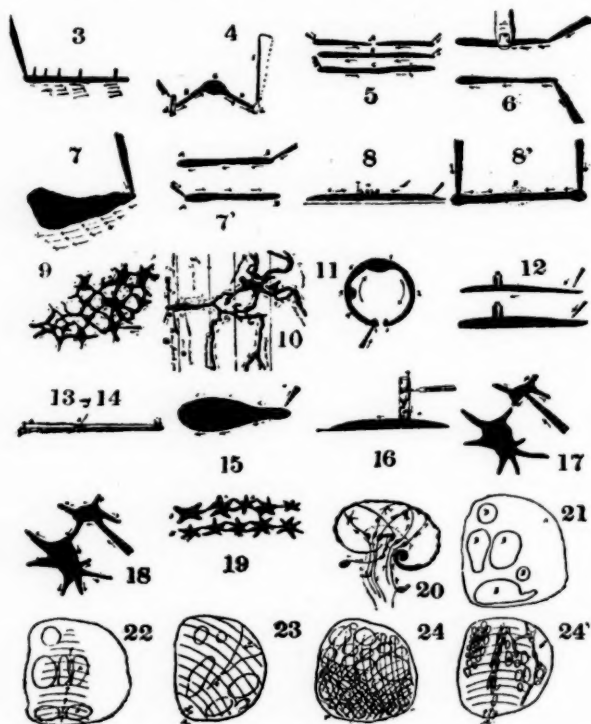
II. The question concerning the origin and functions of the nervous system might be considered as a mechanical problem requiring a laborious solution.

**Experiments and comparisons.**—Pour in a plate a small quantity of mercury whose fluidity has previously been diminished by the addition of a slight proportion of lead: this will serve the

<sup>1</sup> Sociedad Científica "Antonio Alzate." 1898.

purpose of a kind of neuroplasma and receive whatever shape you intend to impress on it, viz., that of a multipolar cell (fig. 17), a cylindrical conductor (fig. 5), etc. Its vibrations may be obtained by the action of azotic or chromic acid, or by means of a small rod or an ant's leg. The vibrations can be verified by fixing a small paper lever on the surface of the liquid, or by receiving a luminous ray reflected on a screen.

Some incidents of nervous transmission are rendered evident by a differential manometer of caoutchouc full of water.



Diagrams illustrating Experiments on Artificial Nerves. For explanation see the text.

(a) **Nervous vibration in general.**—1. The rubbing of a nerve of mercury with a soft feather is enough to make it vibrate.

It is, therefore, probable that a very slight mechanical or chemical action (*e.g.* light) would be able to shake the band axis that is, in general, carefully isolated in the middle of a mixture of fats and albuminous matters. The impressionability of liquids is exceedingly delicate. Milne-Edwards<sup>1</sup> has in the experiments per-

<sup>1</sup> *Physiologie et Anatomie Comparée*, Vol. xii., p. 523; Jamin, *Cours de physique de l'Ecole Polytechnique*. Paris, 1803.

formed by Savart at the College de France seen the shape of some liquid veins change abruptly under the influence of musical notes entirely inappreciable to the ear, that were played at the Luxembourg.

2. The figures below are most interesting :

Velocity of light	300,000,000 metres a second.	
" electricity	180,000,000	"
" sound	331	"
" liquid waves <sup>1</sup>	10	"
" nervous vibrations (Lobster)	8	" (Frédéricq)

" Il ne faut pas confondre la pulsation, l'arrivée d'une onde, avec le mouvement de la circulation lui-même ; on ne peut trop le répéter : *unda non est materia progrediens, sed forma materiae progredientis* : aussi Czermak a prouvé, par des recherches très exactes (sphygmographe à miroir), que tandis que le mouvement du sang diminue de vitesse à mesure qu'on se rapproche des capillaires, la vitesse de propagation de l'onde pulsative va au contraire en augmentant du centre à la périphérie. Onimus a insisté sur ces caractères de l'onde pulsative." (Etudes sur les tracés obtenus par le sphygmographe. *Journal d'anatomie*, 1866.) <sup>2</sup>

It is then extremely probable that a nervous vibration is nothing more than a molecular one, the velocity of which varies in accordance with its conditions, though it never amounts to more than thirty or ninety metres per second. Here are some other proofs :

3. I modified Secchi's classical experiment <sup>3</sup> of pouring a few drops of alcohol on a thin bed of water, by substituting for the former a mixture of alcohol and castor oil, and adding to the water a considerable quantity of linseed oil. Under these conditions a strong agitation takes place. In like manner Longet provoked some local convulsions by touching the motor nerves with alcohol.<sup>4</sup>

4. In most cases mechanical excitation affords real and genuine success,<sup>5</sup> and the excitability of the *Helix* nerves can only be evidenced by means of mechanical and physical irritants. (Milne-Edwards.)

In some animals diverse concretions are present, which oscillate at the least agitation of the external fluid, and increase the mechanic vibration endured by the auditive nervous terminations, rather than translate any currents endowed with a mysterious nature.<sup>6</sup>

I have made a small apparatus tending to demonstrate the influence exercised by otoliths on the vibrations of mercury. It con-

<sup>1</sup> Marey. Mouvements des ondes liquides dans les tubes élastiques. *Journal de physique*, 1875, Vol. ix., p. 257.

<sup>2</sup> Kiess et Duval. Cours de physiologie, Paris, 1879, p. 259.

<sup>3</sup> L'unité des forces physiques, Paris, 1874, p. 73.

<sup>4</sup> Traité de physiologie, Paris, 1869, Vol. iii., p. 209.

<sup>5</sup> Béclard. Traité de physiologie, p. 961.

<sup>6</sup> Chatin. Les organes des sens, p. 301.

sists of a drum full of water, having some artificial otoliths prepared after Ray's method<sup>1</sup> (fig. 16).

It is quite surprising that the study of auditive phenomena, or more properly speaking, that of the vibrations of auditive nervous terminations, has not already suggested the explanation of the important facts connected with innervation.

5. Compression abolishes the function of the natural nerve as well as that of the nerve of mercury, but the aforesaid function may be re-established when compression has not disorganised its anatomical elements deeply or divided the thread of mercury (fig. 6). Richet says<sup>2</sup> that an analogy between blood circulation and nervous conductivity might be established: "Quand on applique une pince sur une artère, on interrompt le cours du sang, qui se rétablit dès qu'on enlève la pince."

The facts regarding transmission of electricity, heat, etc., are completely different.

6. If this or that excitation provokes this or that sensibility, it probably takes rise not in the nature of the nerve itself, but in its connections with these or those centres. (Richet.)

7. The wave increases in bulk as a sort of avalanche in the course of its progress through the nerve (Pflüger) and the thread of mercury (fig. 7). The phenomena may easily be observed by fixing several equidistant levers, so that they may rest on the metallic surface lightly (fig. 3).

8. The variations consequent on temperature are probably due to the variations of density of the band axis in the formula

$$v = \sqrt{\frac{e}{d}}$$

for whenever  $d$  increases  $e$  cools and  $v$  diminishes; and may also be due to the duration afforded to the continuance of the muscle's latent excitation (Marey), or to the discharge of carbon dioxide.

9. Richet regarded negative variation of carbon dioxide as a testimony to the nerve's mechanical vibration.<sup>3</sup> They both have nearly the same amount of velocity. Dr R. Jofre, Director of the Laboratory of Medical Electricity, reminds me of similar and considerable modifications of current taking place in microphones, as a sequence to the mechanical vibrations and insignificant stirrings occasioned by an insect's walk for instance.

"La surface inférieure du lobe sensitif de la Dionée attrape-mouches est électro-négative par rapport à la surface supérieure, au moment où la feuille est irritée: au bout d'une demi-seconde, la sur-

<sup>1</sup> Carpenter. *The Microscope and its Revelations*. London, 1868, p. 775.

<sup>2</sup> Richet. *La vibration nerveuse*. *Revue Scientifique*, Juillet à Décembre 1882, p. 99.

<sup>3</sup> Milne-Edwards, l.c., Vol. xiii., p. 5.

face supérieure devient à son tour électro-négative et reste ainsi pendant quelque temps."<sup>1</sup>

10. Excitants work either by disorganising the nervous textures or by a subtraction of water, that is, either by mechanical acts of disassociation or else by a modification in the density of the axis-band, or even of the neuroplasma itself. The influence exercised by interstitial water on the excitability of nerves appears to be quite evident, the mere fact of a nerve's desiccation rendering it inexcitable, though it is susceptible of recovering its physical and physiological properties when it has retaken by imbibition the quantity of water necessary for the discharge of its functions. Morphia may perhaps work by modifying the state of hydration of the neuroplasm. It is likewise possible that the blood's circulation and its state of concentration have an indirect influence on the velocity of nervous transmission. (Experimental studies of Mosso.)

11. Most acids work as excitants if applied to nerves. This point being settled, I can further state that a similar result is to be obtained by applying to the point of an artificial nerve of mercury and lead a little chromic or azotic acid, either concentrated or diluted. This also produces: (a) Contraction and tumultuous movements. (b) Production of waves, by discharge of nitrogen dioxide. This is certainly one of the most weighty demonstrations of my theory.

The neuroplasm, the axis-band in general, ought to vibrate under the influence of acids, because the chemical action practised by the latter on albuminous matters must originate the shocks and vibrations attendant on the subtraction of water, discharge of carbon dioxide, etc.

It is needless to observe that the movements of the artificial nerve of mercury and lead can be explained by the action of gas when the chromic acid is applied. The bioxide of nitrogen slowly issuing from the bottom of some drops of nitric acid (1 in 10 of water), placed on the surface of the metal, begins to whirl round, after the manner of infusoria, or to produce some amoeboid movements that are extremely curious.<sup>2</sup>

12. Physiologists are all of opinion that bile is one of the nerve's excitants.

In certain parts of the nervous system the continual vibrations observed may be due to the excitant action of oxygenated blood, by a discharge of carbon dioxide.

13. Rough excitations have the power of effecting the nerve's vibrations, while slow and gradual excitations are unable, in spite of

<sup>1</sup> *Revue Scientifique*, Juillet à Décembre 1882, p. 735.

<sup>2</sup> Note the amoeboid movements that Bütschli observed in foams and Præaubert in globular rays. "La vie mode de mouvement." Paris, 1898.

their force, to bring the wave forth. (Experiments of Du Bois-Raymond on the destruction of a nerve by a current of increasing intensity.) It is exactly the same with the nerve of mercury: rub it roughly with a piece of feather and this excitation will soon be answered, but it will remain dumb whenever you rub it slowly and gradually with a cloth.

14. There is transmissibility of the excito-motory vibration from a natural or artificial nerve to another when the latter was not in its normal state connected with the former. Their activity can be brought about by means of a stimulus, after every communication between this organ and the centre of innervation has been completely interrupted. (Fig. 5.)

15. It may be objected that the equilibrium of a liquid is not to be altered by such slight vibrations as those that impress the human auditive nerve. Audition would then be impossible. Moreover, the telephone of mercury is established precisely on the principle according to which the transmission of vibrations is effected by means of mercury, and we here repeat that the liquid veins of Savart were modified at the College de France by some music performed at the Luxembourg, that was entirely inappreciable to the ear.

16. The stamens of the *Centaureae* shrink up in their whole length whenever they are submitted to a mechanical excitation, on account of some laws similar to those that rule the contraction of muscles in higher animals.<sup>1</sup>

Electricity affects Sensitives too if discharged in sparks, but it seems to have no influence whatever when it works by continuous currents. It acts in the same manner on nerves.

The sensibility exhibited by the leaves of *Drosera* is such, that an object placed on them and weighing some 000008 gr. merely, is enough to determine their immediate motion.<sup>2</sup>

17. Mr Kühne has succeeded in the construction of a kind of artificial muscle by stuffing a fragment of *Hydrophilus*' intestine<sup>3</sup> with the semi-fluid protoplasm of a certain *Myxomycetes*. This apparatus was affected by electricity as well as if it had been a real muscle. There is not a special force, therefore, but only a liquid capable of vibration.

(b) **Muscular vibration.**—I cannot dwell long on the important question of muscular vibration without wandering too far from the principal object of the present paper.

The theory of muscular waves as conceived by Marey and Weber has been fully confirmed by the experiments below:

1. Fix a tube of caoutchouc of small diameter by one of its

<sup>1</sup> Claus, *Traité de Zoologie*. 1884, p. 14.

<sup>2</sup> Lubbock. *La vie des plantes*, p. 6.

<sup>3</sup> With nerves and muscles!

extremities and tie it by the other to a weight that can easily slide on a polished surface. At the vibration of the tube, that must be stretched beforehand, the weight is drawn by a quantity equivalent to the extent of the vibration. (Figs. 13 and 14.)

2. By previously stretching a tube it may be induced to vibrate if connected in a point on its middle with a large globule of mercury (nervous termination), the vibrations of which start those of the tube; the locomotion of the weight along the table is the issue of all this. (Figs. 13 and 14.)

This experiment may be considered as a difficult one on account of the computations indispensable to determine the degree of length of the tube and that of the weight which it must attract.

Perhaps the vibration of a muscle is due to the discharges of carbonic oxide.

(c) **Acceleration of the pulsatile wave as observed by Landois in elastic tubes previously filled with water.**—This too is easily observed in threads of mercury and serves to elucidate the question concerning certain reflexes that are simply the result of several successive excitations (ejaculation).

A. L. HERRERA.

MEXICO, May 1st, 1898.

(To be continued.)

## SOME NEW BOOKS

### THE BACKBONED ANIMALS

A CLASSIFICATION OF VERTEBRATA, RECENT AND EXTINCT. By Hans Gadow. 8vo, pp. xvii + 82. London: A. & C. Black, 1898. Price, 3s. 6d. net.

THIS is a valuable and convenient handbook for the use of students attending lectures on the vertebrate animals. It can also be used as a notebook, being printed on one side of the paper only.

Dr Gadow defines the Vertebrata as "bilateral symmetrical animals with segmentally arranged mesoderm, with a central solid axis (Chorda dorsalis, extending through the whole length of the body, from head to tail, hence *holochordate*), dorsally of which lies the tubular central nervous system, ventrally the gut; the respiratory organs arise from the anterior portion of the gut." He then proceeds to define the 'sub-phyla' and smaller divisions with commendable brevity and conciseness. As he remarks, there is no reason to enumerate any but the fundamental characters. "For instance, 'the possession of visceral arches, one pair of which is modified into jaws,' is a quite sufficient diagnosis of the Gnathostomata. The presence of an anterior and a posterior pair of limbs is probably quite as essential and peculiar a feature. There are not, and can never have been, paired-limbed vertebrata without visceral-arch jaws; consequently, wherever the converse is the case, we feel certain that the absence of limbs is a secondarily produced feature." Dr Gadow also lays special stress on skeletal characters, not merely on account of their supreme importance, but also because the vast array of extinct animals can only be treated as skeletons. As he well observes, "we do not *know* that the Palaeozoic Fishes did possess an entirely venous heart, nor has it yet been shown that the embryos of Dinosaurs were surrounded by an amnion; but we feel nevertheless certain, because of the laws of correlation which comparative anatomy allows us to deduct from the study of recent creatures. On the other hand, it is quite possible, even most likely, that the Triassic Pseudosuchia had no copulatory organ, and therefore this feature cannot be admitted into the diagnosis of Crocodilia, at least not if they are to comprise the Pseudo-, Para-, and Eusuchia." Finally, the author is to be commended for his selection of generic names. The book is "meant to be used by the present generation," and hence he employs those names under which the whole story of vertebrate anatomy and zoology has been written, ignoring certain recent papers which are rather literary essays than contributions to knowledge.

Dr Gadow recognises two sub-phyla of Vertebrata, namely the

Acrania (represented by the lancelets) and the Craniota (all other known vertebrates). Of the latter there are three super-classes, Cyclostomata, Hypostomata, and Gnathostomata. The Cyclostomata are arranged in the usual manner. The Hypostomata (new term) are the extinct Ostracodermi of Cope. The Gnathostomata comprise the classes Ichthytes, Amphibia, Reptilia, Aves, and Mammalia. The Ichthytes are again subdivided into the sub-classes of Pisces and Dipnoi, and our present knowledge of extinct fishes is specially taken into account in arranging the minor groups, among which 'Ganoidei' survives no longer, except in a footnote. The arrangement of the Amphibia depends chiefly upon Cope, Boulenger, and Zittel. The Reptilia are grouped in eleven sub-classes, of which seven are extinct. The classification of the Aves is based very largely on the author's own researches, while that of the Mammalia corresponds closely with that of Flower and Huxley.

The authorship of the names of the larger divisions is usually mentioned, and the student is helped occasionally by the addition of synonymous terms. The author's researches, however, into the literature of the subject do not appear to have always extended to the original sources, and hence several errors which ought to be corrected in a future edition. Among other terms for which a wrong authorship is given, we may enumerate Antiarcha, Teleostomi, Pareiosauri, Dinosauria, and Mesosauri. The equivalent terms, also, are not invariably exact; for instance, the Marsupialia are not precisely the Metatheria of Huxley, but merely the specialised surviving representatives of that sub-class. Moreover, we disapprove of the use of one and the same ordinal term (Lepospondyli) in two distinct classes, and the corresponding wide separation of two such closely related genera as *Keratoperdon* and *Hylopleuron*. The arrangement of the Reptilian orders appears to us very unnatural, the closely-related Crocodilia and Dinosauria being separated by the Chelonina, while the latter again are divorced from the Theromorpha and Plesiosauria, their undoubtedly nearest allies. Recent discoveries in Palaeontology seem to have rendered the Chelonian orders Thecophora and Athecae untenable. We also object to one theory of the quadrate bone being stated dogmatically as a fact in the definition of the Mammalia. For actual errors in the diagnosis, however, we have looked almost in vain. There is nothing more seriously incorrect than the statement that all Cetacean teeth are destitute of enamel, or that *Squalodon* has only one-rooted teeth. The index of proper names, too, is admirably done, most terms having their derivation appended.

At the end of his work Dr Gadow adds a useful chapter on the geographical distribution of the Vertebrata, with a table showing the approximate number of the known recent species. He also gives a fanciful though striking calculation to show how some groups are still in the ascendant while others are distinctly declining. The little volume is, indeed, a welcome addition to the biological student's library, and it deserves the wide circulation which its author's eminence is likely to ensure for it.

A. S. W.

## SOLITARY WASPS

THE INSTINCTS AND HABITS OF THE SOLITARY WASPS. By George W. Peckham and Elizabeth G. Peckham. 8vo, pp. 245; 14 plates (2 coloured). Wisconsin Geological and Natural History Survey Bulletin No. 2. Scientific Series No 1. 1898.

IN discussing the problem of Instinct, Darwin wrote, "If it can be shown that instincts do vary ever so little, then I can see no difficulty in natural selection preserving and continually accumulating variations of instinct to any extent that was profitable." This sentence might well serve as the text for the charming book before us, and seems to have been ever present in the minds of our authors during many hours spent in the sweat of the brow, in trying postures, and under a blazing sun in the successful endeavour to learn something from the Solitary Wasps haunting a garden in Wisconsin. The result of their toils may be given in their concluding words:—"The general impression that remains with us as a result of our study of these activities is that their complexity and perfection have been greatly overestimated. We have found them in all stages of development, and are convinced that they have passed through many degrees, from the simple to the complex, by the action of natural selection. Indeed, we find in them beautiful examples of the survival of the fittest." This is a striking contrast to Fabre's remark that had Darwin known the results of his latest observations on the stinging habits of Solitary Wasps, he would have frankly avowed his inability to make instinct enter the mould of his formula. Mr and Mrs Peckham show conclusively that the popular belief that these wasps sting their prey for the purpose of paralysing but not killing, in order that a fresh and not putrid supply of food may be at hand for the offspring is far from correct. Great stress has been laid upon this hitherto accepted belief by Eimer, Romanes, and others, and in view of its wide acceptance among zoologists and the general public it is worth giving a brief outline of the results of our authors' observations on this phenomenon. Out of forty-five species of Solitary Wasps observed by them about one-third kill their prey outright. Of the remainder there is not a single species in which the sting is given with invariable accuracy; in fact, they scarcely sting twice alike since the victims of the same wasp may be killed at once, or may live from one day to six weeks, or even ultimately recover; and this even after treatment by the most skilled surgeons in the hymenopteron world. It is thus at once evident that the sting is not invariably thrust with unfailing accuracy into the nerve centres, and, further, that dead meat is quite as acceptable to the larvae as living flesh—as indeed was fully proved by actual observation. It is of great interest to find that the poison of the wasp's sting has a great paralysing power when introduced into the body of the victim at any point, so that the prey is rendered helpless without the necessity of a complete knowledge of invertebrate anatomy on the part of the wasp. Thus, a leg was broken off a small cray fish, and a *Polistes fusca* made to thrust its sting into the exposed end of the stump, with the result that the cray fish was instantly paralysed and died after a few hours. Similar results followed from causing a *Polistes* to sting a large spider in

various parts of the body remote from the nerve centres, which can therefore only have been affected by the diffusion of the poison.

A pang of regret is almost inevitable as one relegates this well-known zoological fairy-story to the ever increasing category of arm-chair fiction. But any such feelings are more than compensated by the marvellous wealth of observations now put before us. It is difficult to determine on which to dwell in the present notice. We select a few of those bearing on the reputed 'sense of direction' in wasps. It is here shown by numerous instances that these insects do undoubtedly make a careful study of the locality in which they have made their nests, and that a comparatively slight disturbance of the immediate surroundings at once causes them to be at fault. For example, "*Aporus fasciatus* entirely lost her way when we broke off the leaf that covered her nest, but found it without trouble when the missing object was replaced." We might quote many more instances of the same character. We may perhaps be allowed to confirm this opinion by an observation of our own. Some five years ago we chanced upon a nest of *Vespa sylvestris* built in an old tin at the bottom of a ditch; while the wasps were in full work the tin was moved about three yards on to the bank of the ditch; all the wasps that were within the nest at the time of removal noticed as soon as they came to the exit from the nest that their position had been changed, and instead of at once flying off they stood on the edge of the tin for some moments, then took short flights to and fro, gradually increasing their range until they extended to the ditch, the old familiar spot, when they went straight away. It is only necessary to consult the pages of the memoir under notice to be convinced that among wasps, at any rate, there is no such thing as 'sense of direction,' but that their 'homing' powers are the result of preliminary survey and subsequent memory.

Of the many wonderful devices and signs of intelligence observed, the most astounding is that related of *Ammophila urnaria*. Many individuals of this species were carefully watched making their burrows, catching and stinging their caterpillars, conveying them to the subterranean larder and closing the aperture with lumps of earth, small stones, etc., in order to conceal it from the marauding red ants. As among ourselves so too here some individuals are slovenly and careless in their work, others bestow upon it all the assiduous care of the artist. Of these the last one, already remarkable for her perfect workmanship, reached an excellence that is almost incredible were it not supported by such reliable testimony as that of Mr and Mrs Peckham, and further substantiated by an independent observation by Dr S. W. Williston on another individual elsewhere. This wasp having stored her nest proceeded to fill it up with grains of fine dirt, and "picking up a small pebble in her mandibles used it as a hammer in pounding them down with rapid strokes, thus making the spot as hard and firm as the surrounding surface. Before we could recover from our astonishment at this performance she had dropped her stone and was bringing more earth. We threw ourselves down on the ground that not a motion might be lost, and in a moment we saw her pick up the pebble and again pound the earth into place with it, hammering now here and now there until all was level." Such an

operation as this is nothing less than the intelligent use of a tool, a phenomenon which is well-nigh unexampled even among the higher mammals.

Throughout the whole memoir there occur records of observations of the greatest interest,—for example the part taken by the males of the genus *Trypoxylon* in guarding the nest from parasites during construction; the deterrent effect of the odour of a bug upon a spider; the readiness of some wasps to steal the victims of their sisters, and their unwillingness to accept spiders offered to them by the observers; while hardly less interesting are the not infrequent mentions of apparent failure of instinct. Eight primary instincts are recognised as the result of these very complete observations, viz.—stinging; taking a particular kind of food; method of attacking and capturing prey; method of carrying prey; preparing nest and then capturing prey, or the reverse; mode of taking prey into the nest; general style or locality of nest; spinning or not spinning of a cocoon, and its specific form when made. Variations showing an appreciative adaptation to slight changes of environment are regarded as acts of intelligence.

The work is an excellent example of the value of systematic and painstaking records compiled in the field, and has a healthy outdoor flavour about it. It should be of immense use to many of our Natural History Societies as a model to the zealous amateur of the way in which he may by the careful study of the habits of animals haunting his own paddock or garden contribute to the storehouses of our knowledge facts which help to elucidate some of the most difficult and abstruse problems in bionomics.

O. H. L.

#### ALCOHOLISM

THE TEMPERANCE QUESTION FROM A BIOLOGICAL STANDPOINT. By G. Archdall Reid, M.B. *The Medical Magazine*, June and July 1898. 26 pp.

IN the case of a treatise written from a profoundly scientific point of view, fault might be found with the use of the word "Temperance" in the title. As it stands the title suggests a scientific discussion as to moderation in all respects; but the treatise itself is only concerned with moderation in one particular case—in regard to the use of alcohol. So in a scientific discussion the author starts by using a term in its popular sense.

This is not intended as a captious criticism. In a scientific discussion exactitude in terminology is an absolute necessity. Much of the trouble and half the disagreement shewn in such discussions arise from the fact that it is not always easy to understand whether a writer uses a term in its literal or in its popular sense. So that care in this matter is most essential. In a notice in these pages of a previous work by Mr Reid, it was pointed out that he used the term 'evolution' in two senses. He has in the present case profited by the criticism so far as to admit this, and to state in which sense he now employs it.

To come to the question at issue. In regard to Alcoholism Mr Reid puts forward the following as his surmises and arguments:—

1. That acquired characters are not transmissible.

2. That the craving for alcohol is innate in the human race, and is not an acquired character.

3. That human beings differ in the degree in which they possess this craving—that there are the more alcoholically inclined and the less so. But if a man with a great alcoholic craving is able to satisfy this craving with drink, even to his own injury, or is prevented by prohibition measures from satisfying it, his offspring will not in the one case be the more drunken, or in the other case the more sober: they will only inherit the innate craving which he possessed.

4. That the peoples who have had the most experience of alcohol are the least inclined to excessive indulgence therein.

5. That this result has been brought about because alcohol is such a rank poison that it has effectually and constantly killed off the individuals of the nations who were most prone to excessive indulgence, and so left the field free for the breeding of those who were less alcoholically inclined.

It is hoped that this statement does full justice to the position which Mr Reid takes up. It is a very extraordinary position, with a maximum of surmise and a minimum of proof. It suggests a case of a man seeing a flash of lightning and subsequently a house in ruins jumping to the conclusion that the former was the cause of the latter, because such events have been known to occur, without being able to show (1) that the lightning did strike the house; (2) that the house was not in ruins before.

Because the main argument of Mr Reid is that savages have drunk themselves to death. And considering the raw, much adulterated liquid fire with which Christian traders have taken so much pains to supply them, there is not much wonder thereat. But to conclude therefore that the nations of Southern Europe have become temperate because all the alcoholically inclined individuals have been killed off by drink is most rash. What warrant is there for such an assumption in our own case? for, according to Mr Reid, we are in the stage of alcoholism that the southern peoples were in long years ago. But what do we see?—that the most alcoholically inclined, the labourers and artisans, breed in about the proportion of 3 to 1 in regard to the less alcoholically inclined remainder of the population. Wherefore, according to Mr. Reid, we should be getting a more drunken nation with every generation.

This is one of the missing links in Mr Reid's chain of evidence. For in order to prove that alcoholic over-indulgence is an eliminator of the unfit, he must shew that it is so deadly a habit as to kill off its votaries before they have been able to produce as many offspring as the rest of the population. This he does not do. He actually admits that among women alcoholism is not manifest till late in life. But for the purposes of elimination it does not matter in the least if a woman who has passed the procreative period kill herself off in five years with drink, or live to be ninety in soberness. And so with the agricultural labourer,—he may kill himself with drink at forty-five; but if he has at that age, as is not infrequent, added some twelve or fifteen children to the next generation, he has done more to propagate his kind than has the sober professional man who lives to be seventy and has five children.

I may mention in this case a rather instructive lesson learnt from the growing of crops of *Datura tatula* for medicinal purposes. Among the plants there are two marked varieties—(1) The respectable class who most fulfil the purpose for which they are grown, by producing most leaf and stalk per acre; (2) The waster class, whose sole object in life seems to be to produce seed. Now if the individuals of the two classes were numerically equal in one generation, and seed were saved equally from the whole, class 2 would far outnumber class 1 in the subsequent generation because of its greater fecundity. But class 2 has a worse character than this—it not only produces more seed but it makes sure to ripen that seed the earlier, so that when the crop is cut there is far more ripe seed of class 2 than there is of class 1. Wherefore class 1 should in a few years have almost disappeared to vanishing point.

But artificial selection is far more ruthless than any form of natural selection, so called. We go through the crop with thoroughness to destroy the plants of class 2, so that there may be no seed from them for the next generation. And yet partly perhaps owing to the immensely greater fecundity of the wasters, partly perhaps to an innate tendency of the respectable class to become wasters, in spite of several years' ruthless efforts at extermination, the individuals of the waster class are as numerous as ever. No alcoholic selection would be as vigorous as that. *A fortiori* it would fail even more lamentably.

If Mr Reid could free himself from the fetish of natural selection, and could bring himself to think that acquired characters are inherited, though he may not know how, then he would find himself able to account for the increased sobriety of the nations who have longest known alcohol. Such account would take the following form—that familiarity breeds contempt, and that an acquired character of restraint is inherited until it becomes a second habit performed quite unconsciously.

It is well known that if an individual be introduced to an unaccustomed pleasure he rushes thereat for a while, possibly overdoes it, and then becomes satiated. Instances are all around us. And what is possible for the individual is possible for the race: it may be alcoholically satiated.

As regards the acquired character of restraint, Mr Reid doubts its existence. He puts it in the other way, that the craving is less. Here it is said the craving is the same but the power of restraint is greater. The difference is important. If two cycles of equal weight are started at the top of a hill the tendency to run away is equal in both. But if one be fitted with a brake its running away propensities are checked; not because the craving to run away is less, but because the brake power—the restraint—is greater. And that is the case with man and alcohol. The sober individual and his parents before him have exercised restraint until it has become a second habit—performed with as little consciousness as walking.

And there is a case strictly analogous, in the acquired restraint which man habitually and often unconsciously uses over his bodily functions. In the case of the urinary organs such restraint is the cause of many diseases and frequently of death, wherefore, according to

Mr Reid, the less restraining portion of the population should be in the majority through elimination, of those practising restraint. But, in spite of any such elimination man, compared to other animals, has advanced enormously in regard to the acquired character of functional restraint.

But Mr Reid says "if acquired characters are transmissible, prohibition is undoubtedly right." That cannot be endorsed; because if there were prohibition there would be no training in the exercise of personal restraint, the power to exercise restraint in necessary cases would be lost, and the last state would be worse than the first.

It is impossible to touch more than the fringe of such a question as alcoholism. But one thing may be said—the best forms of temperance legislation would be—(1) rigidly carried out enactments against food and drink adulteration; (2) nationalization of education.

S. S. BUCKMAN.

#### RADIATION

RADIATION. By H. H. Francis Hyndman, with a preface by Prof. Sylvanus P. Thompson. pp. xviii + 307. London: Swan Sonnenschein. 1898.

RADIATION links together the principal branches of Physics. It is on this account difficult to obtain a connected view of the subject by a perusal of the ordinary text-books. Mr Hyndman's treatise is, therefore, very welcome. After a brief introduction mainly on wave-motion the author discusses vibrations in matter, in the ether, and lastly, those vibrations such as the Cathode, Röntgen Rays, etc., the nature of which is not yet definitely known. The advanced student will find the book useful, both intrinsically and on account of the copious list of references; whilst it is sufficiently elementary to be intelligible to a larger class of readers with but a slight knowledge of Physics. A few slips have been noticed. The explanation of the sound of organ-pipes and other wind-instruments given on p. 20 is not correct; there is little motion of translation in such instruments, as anyone, who has tried to sound a horn by blowing down it, knows. Again, on p. 130, possibly owing to an error of copying, 'biaxial' has been substituted for 'uniaxial.' It is certain uniaxial crystals which rotate the plane of polarisation when polarised light is transmitted parallel to the optic axis. These small blemishes do not detract from the merits of this interesting book.

#### THE LIBRARY OF THE DRESDEN MUSEUM

Dr A. B. MEYER has caused to be compiled a *Catalog der Handbibliothek des Königlichen Zoologischen und Anthropologisch-Ethnographischen Museums in Dresden*, alphabetical and systematic. The volume is an octavo of xxiv., 288 pages, and is issued by the Museum. The entries are brief and recognisable, though not bibliographic, and the serials and publications of academies fall into one alphabet with the authors. The subject indexes should be of much use to readers, especially the ethnographical, which is arranged under countries.

## LITERATURE OF RUSSIAN GEOLOGY

WE are glad to note that Dr Nikitin's "Russkaya gheologhicheskaya biblioteka" for 1896 [dated 1897] reached England 1st September. Like all records this valuable publication grows in bulk year by year, with, of course, a corresponding difficulty of compilation. This difficulty has now proved insuperable to Dr Nikitin and his collaborator, Miss Marie Tzvetaev, and the work will in future be continued by a special committee of the members of the Commission of the Geological Committee of St Petersburg, of whose publications this biography forms a part. The compiler records 577 papers in the geology of Russia, which, if in Russian, are given a translation of title and brief abstract in French, and if in any other language, are similarly dealt with in Russian.

## BIBLIOGRAPHY OF SCIENTIFIC SERIALS

A NEW edition of Dr Carrington Bolton's invaluable Catalogue of Scientific Periodicals has just been issued by the Smithsonian Institution. Part I. of the alphabetical catalogue is a reprint from the plates of the first edition, with the necessary changes to bring the titles down to date. Part II. contains additions that could not be made to the plates of Part I., together with about 3600 new titles. 8600 periodicals are noted in this catalogue.

## SCRAPS FROM SERIALS

THE *Proceedings of the Geologists' Association* for August are devoted to a sketch of the geology of the Birmingham district by Professors Lapworth and Watts and Mr W. J. Harrison. The Association, it will be remembered, visited the district this summer, and this modestly-named sketch is 103 pages long, and is fully illustrated by photographs and horizontal sections, and is really a masterly account of the geology of the Midlands. The following list of contents will give some idea of its value:—Physiography; Geology; Archaean rocks of Malvern, Wrekin, Barnt Green, Caldecote, and Charnwood; Cambrian System of Wrekin, Malvern, Nuneaton, and Lower Lickey; Silurian System of Malvern, Abberley, the central area, Lower Lickey, Walsall, Dudley, etc.; Carboniferous System of S. Staffordshire Coal-field, Lower Lickey, E. Warwickshire and Severn Coal-fields; Permian System; Triassic System; Post-Triassic Formations; Petrology; Ancient Glaciers of the Midlands; and last, but not by any means the least important, is a history of discovery in the Birmingham district, a valuable adjunct to most unofficial work. The Geologists' Association may well be proud of the interest shown in them by Professor Lapworth and Watts. A new term 'Charnian' is proposed in the paper (p. 335) by Prof. Watts for the Charnwood series.

No. xvi. of the *Bulletin of the Natural History Society of New Brunswick* contains a portrait and life of Dr James Robb by Dr L. W. Bailey. Dr Robb published as early as 1841 a paper on the geology of New Brunswick in the Reports of the British Association, and followed it up in 1850 with a report on the agricultural capabilities of the province, to which he appended a geological map. He died in

1861. Mr S. W. Kain has a paper on New Brunswick earthquakes. Mr John Moser deals with the mosses, Philip Cox with the batrachia, W. F. Ganong with the natural history and physiography, and G. F. Matthew describes recent discoveries in the San John Group. A bibliography of scientific publications relating to New Brunswick is contributed by S. W. Kain.

No. 30 of the *Journal of the Straits Branch of the Royal Asiatic Society* contains a paper by H. W. Ridley on the birds in the Botanic Gardens, Singapore, one by the same author on plants of the genus *Peliosanthes* of the Malay Peninsula, and yet another on the White Snake of the Salangor Caves, *Coluber taeniurus*. Some valuable papers on Malay Magic, Folk Lore, the game of Chap Ji Ki, and the oldest Malay MS. now extant, make up a substantial and creditable journal.

The Wisconsin Geological and Natural History Survey have started a series of Bulletins. No. 1 is by Filibert Roth, special agent of the United States Department of Agriculture, and is on the forestry conditions of Northern Wisconsin. There is a map. No. 2, by Geo. W. and Elizabeth G. Peckham, is entitled "Instincts and habits of Solitary Wasps," and is a volume of 245 pp., and 14 plates. We hope to refer to these again later.

These Bulletins are to form three series—Scientific, Economic, and Educational. Mr Roth's paper belongs to the second series, and is to be followed by one on the building stones of Wisconsin by E. R. Buckley; the wasp paper belongs to the first series, and is to be followed by Geology of the Pre-Cambrian igneous rocks of the Fox River Valley by S. Weidman; the three first papers in the Educational series will be Collie's Physiography of Southern Wisconsin, Salisbury's Physical Geography and Geology of the dells of the Wisconsin and the Devil's Lake, and Cheney's forest trees of Wisconsin. The Wisconsin Survey was only established in 1897, and is under the direction of Mr. E. A. Birge, Madison, Wis.

The *Boletim de Museu Paraense* for June contains a plan of the Museum of Para and attached Botanical Gardens, with a description by Dr E. Goeldi. Dr J. Huber contributes materials for an Amazonian flora, Dr C. F. Hartt continues his notes on some inedited works of the Geological Commission of Brazil, and Dr Huber writes on *Vochysia Goeldii*, a new species of the Ferrugineae. Photographs of *Hymenaea Courbaril*, L. and *Crudya Parivora*, De C., are also given.

The *Naturalist* for October contains an account of an ancient Lake-dwelling at Sand-le-Mere, near Withernsea, E. Yorkshire, by Thos. Sheppard. The Rev. W. C. Hey gives a list of Bird names in use at West Ayton, Yorkshire, and there are some interesting notes from the Churchwarden's accounts of Terrington concerning the killing of polecats, which have been extracted by John Wright.

The *Irish Naturalist* for October includes a paper by Dr C. J. Patten, on the birds of Dublin Bay. In *La Feuille des Jeunes Naturalistes* Fournier concludes his paper on the Jura Chain and Eugène Simon concludes his revision of the genera of Humming-birds. In the *Journal of the Limerick Field Club*, Part II., there is a paper by Dr W. A. Foggerty on the Flora of the Limerick district. As it is full of misprints and includes enough rarities of the Irish flora to cause a pilgrimage, it is but fair to say that Dr Foggerty is

only a compiler, and the authorship of the paper belongs to several botanical members. The *Halifax Naturalist* for October contains a sympathetic life of James Spencer, one of the band of workers associated with the late Jas. W. Davis, Samuel Gibson, and others at Halifax; a continuation of Mr Crump's Flora of Halifax, and other papers.

#### FURTHER LITERATURE RECEIVED

THE Principles of Biology, Vol. i., Herbert Spencer: Williams & Norgate. Relations of the Oneonta, Ithaca, and Portage Groups in Central New York; Crustaceans from the Chemung Group of New York; and Sphinctozoan Calcsponge from the Upper Carboniferous of Nebraska: J. M. Clarke, extracts from serials. Mesenteries and Siphonoglyphs in *Metridium marginatum*: G. H. Parker, *Bull. Mus. Comp. Zool. Harvard. Bol. Mus. Purpure* for June. History of Mankind, Ratzel, Part 29: Macmillan. Life History of Oyster, W. A. Herdman, *Brit. Assoc.* Truth about the Game Laws, J. Connell: Humanitarian League. Zweckmässigkeit und Anpassung, J. W. Sprengel: Fischer. *Bull. Illinois State Lab.*, vol. v., art. 4 and 5. Contributions to the Morphology of the Lepidoptera; Eimer's researches on Eastern Papilios, by K. Jordan: *Novit. Zool.* Catalogue der Handbibliothek des K. Zool. Anth.-Eth. Mus. in Dresden. Beiträge zur Physiologie des Centralnervensystems, Part i., Hypnose der Thiere, Max Verworn: Fischer. *Bull. N. H. Soc. New Brunswick*, No. xvi. Geology of the Basalt Workings, Mt. Rainbow Gold Field; Queensland Minister of Mines. Geological Observations in Ayrshire and other tracts, T. Mellard Reade. Dictionary of Bird Notes, Chas. Louis Hett: Jackson, Brigg. The New Age,—Calcutta, for July. *Journ. Straits Branch, Royal Asiatic Society*, July. The Witness of Science to Linguistic Anarchy, Lady Welby: privately printed. The living Organism, an introduction to the problems of Biology, Alfred Earl: Macmillan. Eclipses of the Moon in India, Robert Sewell, being a continuation of the "Indian Calendar," price 10s. 6d.: Swan Sonnenschein. Report of the Marine Biologist for 1897, Dept. of Agriculture, Cape of Good Hope "P.P., G. 53-'98." Grasses of New South Wales, J. H. Maiden: Minister of Agriculture, N.S. Wales. L'Année biologique, Yves Delage, for 1896: Schleicher Frères. Sea Fisheries, Report on the Trawling Operations of H.M.C.S. "Thetis" under the direction of Frank Farnell, with a scientific report on the fishes by E. R. Waite: New South Wales Government publications, No. 23571. Specializations of the Lepidopterous wing, A. R. Grote: *Proc. Amer. Phil. Soc.*, xxxvii. Vegetation of Lord Howe Island, J. H. Maiden: *Proc. Linn. Soc. N.S.W.* Flora of Mt. Kosciusko, J. H. Maiden: *Misc. Publ. Dept. Agric.*, N.S.W., No. 241. Tendency of Religion, Col. R. Elias: Chapman & Hall. Lectures on Mathematics, J. C. Lagrange: Open Court Publ. Co., Chicago. Rep. and Trans. South Eastern Union of Scientific Societies, for 1898. Ann. Progress Report of Geological Survey of Western Australia for 1897.

Amer. Geol., Sept.; Amer. Nat., Sept.; Annot. Zool. Japan, vol. ii. pt. 2; L'Anthropologie, June-Aug.; Bol. Naturalista, No. 8; Bot. Gazette, Sept.; Feuille des jeunes Nat., Oct.; Halifax Nat., Oct.; Irish Nat., Oct.; Journ. School. Geogr., Sept.; Literary Digest, Sept. 10, 17, 24, Oct. 1; Naturae Novit., Sept., and Index to 1897; Naturalist, Oct.; Nature, Sept. 15, 22, 29, Oct. 6, 13, 21; Nature Notes, Oct.; Naturen, Sept.; Photogram, Oct.; Plant World, Sept.; Review of Reviews, Sept.; Revue Mensuelle Bibl. Sci., Aug.; Revue Scient., Sept. 17, 24, Oct. 1, 8, 15; Rivista Ital. Sci. Nat., Sept.-Oct.; Rivista Quin. Psychol., fasc. 8, 9, 10; Scott. Med. Surg. Journ., Oct.; Science, Sept. 9, 16, 23, 30; Scientific Amer., Sept. 10, 17, 24, Oct. 1; Westminster Review, Sept. Oct.

## OBITUARIES

## GEORGE GREY

BORN 1812. DIED 19TH SEPTEMBER 1898

SIR GEORGE GREY was born at Lisbon, educated at Sandhurst, entered the army in 1829, and became captain in 1855. Retiring from the profession, he conducted two expeditions of discovery in the north-west and west of Australia from 1837 to 1839, the results of his travels appearing in 1841. His collections were worked out by J. E. Gray, J. Gould, and Adam White. In 1841 he was appointed Governor of South Australia, and in 1845 of New Zealand, to which colony the rest of his life was devoted, with the exception of a period of Governorship of Cape Colony. Sir George Grey's valuable Colonial services are too well known to need repetition here, but a few words are necessary to emphasize his services to zoology, which were of no ordinary kind. A deep friendship with Richard Owen led him to seize every available opportunity for collecting the fauna of the lands he visited, and his own inclination led him towards the music, folk lore, and dialects of the native inhabitants. In a letter to Owen in 1849 he deploras the burning of his New Zealand home and the loss of a complete skeleton of moa, three moa skulls, besides numerous other bones, the skeleton of what was probably a *Notornis*, and bones of a quadruped. But with his characteristic courage, he adds, "I will endeavour in the course of this summer to collect again." The *Daily Chronicle* for October 18 has, we are glad to see, started a national memorial to this great public servant.

## LOUIS LAURENT GABRIEL DE MORTILLET

BORN 29TH AUGUST 1821. DIED SEPTEMBER 1898

It is noticeable that in nearly every field of intellectual research some few enthusiastic observers and thinkers are alone the first tillers of the new soil, often amidst troubles and disappointments. So in Anthropology, an important division of Archaeological study, Mr G. de Mortillet, following up the investigations of Mr Boucher de Perthes, was one of the forward workers in this field of research. By his co-operation in compiling and editing the "*Matériaux pour l'Histoire positive et philosophique (primitive et naturelle) de l'Homme*," together with Trutat, Cartailhac, and others, he greatly aided the advancement of his favourite science, accumulating facts, and forming and distributing useful generalisations as to the probable succession of the various cave-dwellers in Central France and elsewhere. Taking as the basis of his calculations the results of the examination of the caves of Dordogne and neighbouring districts, and the comparison of the animal remains, and the typical stone and bone implements, he sug-

gested that (1) Le Moustier cave is characteristic of the oldest stage of the prehistoric occupancy in this region; then (2) the deposits of Solutré; (3) the Aurignac cave; and (4) that of La Madelaine.

Modifications of this chronological classification have been suggested; but, as planned by Mr G. de Mortillet, it has been useful to the Archaeologists of Western Europe in describing their work and grouping their materials. He followed this system in his steady endeavour to advance the progress of his favourite science by organising Congresses of Prehistoric Anthropology and Archaeology, arranging and superintending the Museum of Antiquities at St Germain (1868), and helping to found the Anthropological School at Paris (1875), of which he became professor.

Among his many writings in the "*Matériaux pour l'Histoire*," &c., and elsewhere, whether explicit or suggestive, we may refer to his "*La signe de la Croix avant le Christianisme*" (1866) and "*Origine de la Navigation et de la Pêche*" (1867); both full of useful information in a clear and carefully ordinate form. His studies of mollusca, the geology of Savoy, the pottery of Allobroges, as well as many contributions on prehistoric peoples and conditions in the periodicals of the day bear witness to his earnest work in his patriotic exposition of the history of those who were the early inhabitants of his beloved France.

He was born in 1821 at Meylan, and educated at Chambéry and Paris. He left France in 1849 to escape imprisonment for a socialistic publication, retiring to Savoy and Switzerland, where he arranged the museums of Annecy and Geneva. In 1856 he took scientific work in Italy; in 1864 he returned to Paris, and took up anthropological studies as detailed above.

JAMES HARDY, of Cockburnspath, died in October, aged eighty-four. Dr Hardy was a student of Edinburgh University, and became connected with the Berwickshire Naturalists' Field Club in 1839, in which year he first contributed to the *Proceedings*. He had been secretary for many years to the Club, and as his knowledge was encyclopaedic, north-country zoology and folk-lore have sustained a great loss.

Among others whose deaths have been recently announced are:—Prof. RUDOLPH ADAMY, director of the ethnographical collection at the Hesse State Museum, Darmstadt, on January 14, aged 48; Prof. ANDREAS ARZRUNI, the well-known mineralogist and chemist, in October; JAMES BEHRENS, the lepidopterologist, at San José, Cal., on March 6, aged 74; EUGENIO BETTONI, director of the Brescia Fisheries Station, on August 5, aged 53; Dr ARNOLD GRAF, the morphologist, at Boston, on September 3, aged 30; C. J. H. GRAVENHORST, editor of the *Deutschen Illustrierten Bienenzeitung*, at Wilsnack, on August 24, aged 75; HERBERT LYON JONES, professor of biology at Oberlin College, at Granville, Ohio, August 27, aged 32; Prof. BRONISLAUS KOTULA, the plant-geographer, by an avalanche near Frafol, on August 19; Dr JOSEPH A. LINTNER, the State entomologist of New York, at Albany, on May 5; DIETRICH NASSE, professor of surgery at Berlin University, at Pontresina, on September 1, aged 38; ROMAN ORIOL, professor of mining at the Academy of Mines, Madrid, and editor of the *Revista Miniera*; JOHNSON PETTIT, the entomologist, at Grimsby, Canada, on February 18; Dr H. PRÜSCHOLDT, the geologist and palaeontologist, formerly of the Realgymnasium of Meiningen, recently, by suicide; Dr GIAMBATTISTA VALENZA, the zoologist, at Pantelleria, on June 15; JOSÉ VILLALONGA, the ironmaster, at Bilbao; Dr JAN DE WINDT, the geologist, drowned in Lake Tanganyika, on August 9, aged 22.

## NEWS

THE following appointments have recently been made:—C. A. Barber as government botanist at Madras, in the room of the late M. A. Lawson; Dr G. Bode as assistant in the Botanical Institute, Innsbrück University; Dr Arthur Bornträger as director of the Agricultural Station at Palermo; Dr O. Brefeld, of Münster Academy, has been called to the University of Breslau; Miss Agnes M. Claypole as assistant in microscopy, histology, and embryology at Cornell University; E. A. Minchin, of Merton College, Oxford, to succeed Mr Beddard as lecturer on biology at Guy's Hospital; Dr Stephen Crowe and Dr E. S. Pillsbury as assistants in bacteriology at the San Francisco College of Physicians and Surgeons; Dr W. H. Dafert as director of the Agricultural Chemical Station in Vienna; Mr R. A. Daly as instructor in physiography in Harvard University; Dr Vincenzo Diamare as first assistant in comparative anatomy at Naples University; S. T. Dunny as secretary to the director of Kew Gardens; Stanley Flower of the King of Siam's Museum at Bangkok, as superintendent of the Cairo Zoological Gardens; W. J. Gies as instructor in physiology at Yale University; Prof. Hofer of Munich as professor of geography in Würzburg University; Wm. Jas. Hornaday of Buffalo as director of the Zoological Gardens in New York, and John Alden Loring of Owego as his assistant; Dr Friedrich Katzer of the Para Museum as geologist to the Sarajevo Museum, Bosnia; Oskar Loew, of Tokio, as chemical plant-physiologist to the Dept. of Agriculture at Washington; Prof. Herbert Osborn, of Iowa Agricultural College, to the chair of zoology at Ohio State University; H. J. Patterson as director of the Maryland Agricultural Experiment Station, *vice* R. H. Miller resigned; A. H. Phillips, as assistant-professor in mineralogy at Princeton University; Dr C. H. Richardson as instructor in geology, and Dr H. S. Jennings (temporarily) in the Dartmouth College, N.S.; Dr Wilhelm Schimper, of Bonn, succeeds Dr Klebs as professor of botany at Basle; Dr Oswald Selliger, of Berlin, as professor of zoology at Rostock University; Dr Mark V. Slingerland, of Cornell, as state entomologist of New York in the place of the late Dr J. A. Lintner; Dr Ernest Stolley, of Kiel, as geologist in the National Museum of Buenos Ayres; Prof. C. H. Townsend as biogeographer and systematic entomologist to the New Mexico Agricultural College and Experiment Station, T. D. A. Cockerell professor of entomology, and E. O. Wooten professor of botany there; Dr C. O. Townsend, of Barnard College, as botanist and plant pathologist for the State of Maryland; Dr Voges, of Berlin, as director of the Bacteriological Institute at Buenos Ayres; Prof. Volken as one of the custodians of the Botanic Gardens in Berlin; Dr Julius Nikolaus Wagner as professor of zoology in the University of St Petersburg; Dr Zukal as professor of forestry at the High School for Agronomy in Vienna.

A *replica* of the Hon. John Collier's portrait of Huxley has been presented to the National Gallery by Mr Collier.

SIR JOHN MURRAY has resigned the post of scientific member of the Fishery Board for Scotland.

ACCORDING to *Nature* the vacancy at Kew caused by the appointment of Mr Morris as Commissioner of Agriculture to the West Indies, will not be filled up. It seems a pity that a good botanical post has been lost.

By a slip last month we recorded an item of news that belonged to last year. Mr J. H. Collins was this year the recipient of the Bolitho Gold Medal.

PROF. G. S. MORSE has received from the Emperor of Japan the Order of the Third Class of the Rising Sun "in recognition of your signal service while you were in the faculty of science in the Imperial University of Tokio, and also in opening in our country the way for zoological, ethnological, and anthropological science, and in establishing the institutions for the same."

PROF. DR SIMON SCHWENDERER, Director of the botanical institute of the Berlin University, has been made a knight of the order *Pour le Merite*, in the class of Science and Art.

PROFESSOR KNUTH of Kiel started in October on a scientific expedition round the world. According to the *Botanisches Centralblatt*, he will be away eight or ten months, and will visit India, Java, China, Japan, Hawaii, and North America.

THE Hayden Memorial Geological Award for 1898 goes to Prof. Otto Martin Torell, director of the Geological Survey of Sweden. It is conferred by the Academy of Natural Sciences of Philadelphia, and consists of a bronze medal and the interest on the endowment funds.

MR W. P. PYCRAFT of the British Museum has been entrusted with the examination and description of the embryology, pterylography, etc., of the Megapodes and other birds, collected by the Willey Expedition.

MR W. R. OGILVIE GRANT of the British Museum, and Dr H. O. Forbes of the Liverpool Museum, accompanied by a taxidermist, leave on the 28th October for a scientific exploration of the Island of Socotra. They will remain there about three months, and will make a general collection of the natural history of the island. Among other interesting things to be looked for are supposed new forms of a wild goat and a wild ass. Dr Forbes will no doubt get a few lessons in turtle-riding.

WE understand that a paper left behind by the late Félix Bernard of Paris, entitled "*Recherches ontogéniques et morphologique sur la coquille des Lamelli-branches*" will be published shortly in the *Annales des Sciences Naturelles*. We are extremely glad to find that some one is looking after the manuscripts of our lamented friend.

THE *Botanical Gazette* states that Mr A. A. Heller has resigned his position at the University of Minnesota, to devote himself entirely to collecting. Correspondence having reference to the Exchange Bureau should therefore be addressed to Prof. Conway Macmillan.

DR SCHARFF and Mr Welch have, according to the *Irish Naturalist*, made a preliminary dredging trip to Lough Neagh, with interesting results. Dr Scharff and Mr G. H. Carpenter made a preliminary exploration of Macgillicuddy's Reeks in September and hope to publish their results shortly in the above-named journal.

SIR DYCE DUCKWORTH delivered the Harveian Oration at the College of Physicians on October 18. Dr Wm. Ord will deliver the Bradshaw Lecture on November 10. The Goulstonian Lectures for 1899 will be devoted to the pathology of the thyroid gland, and will be delivered by Dr G. R. Murray. The 1899 Lumleian Lectures will be delivered by Dr Samuel Gee. The Croonian Lecturer for 1899 is Prof. Bradbury, and for 1900 Dr F. W. Mott.—*Nature*.

THE Biological Station of the University of Indiana will next year be in Winona Park, Warsaw, Ind., eighteen miles from its present station in Vawter Park. One hundred and five students, representing eight States, were present this year, the session closing on August 18. The session consisted of two terms

of five weeks each. Courses were offered in elementary geology, embryology, bacteriology, and botany. According to *Science*, thirteen instructors and assistants attended to the wants of the students.

THE Thompson-Yates laboratories of physiology and pathology at University College, Liverpool, were opened on October 8 by Lord Lister.

THE \$500,000 given to the Medical College of Cornell came from Colonel Oliver H. Payne. This is for a building, his total gift being \$1,500,000. Work on the structure has already commenced and it is expected that the building will be finished in 1899. Brown University benefits under the will of Rowland Hazard of Peacedale, Rhode Island, to the amount of \$100,000. Mr George A. Gardner has given \$20,000 to the Massachusetts Institute of Technology, to be added to the general endowment fund. *Science* also states that Dr D. K. Pearsons of Chicago offers \$50,000 to Fair Mount College, Wichita, Kans., provided \$150,000 can be raised.

*Science* states that the Library and Natural History Museum of New Westminster, British Columbia, were totally destroyed by fire on September 11.

THE National Museum of Buenos Aires, which has for many years issued substantial contributions to Natural Science in its *Anales*, has just commenced a smaller publication termed the *Comunicaciones* of the Museum, intended for the prompt issue of small and preliminary communications. Except a short note on a new plant (*Prosopanche benacinaei*) by C. Spegazzini, all the papers in the first number are from the pen of the Director, Dr Carlos Berg.

MR A. S. WOODWARD, of the British Museum, has this autumn visited some of the Swiss Museums for the purpose of examining fossil fishes. He informs us that, among others, he had the privilege of seeing the original collection left by Agassiz in Neuchâtel. Most of these are British specimens communicated to the author of the "*Recherches sur les Poissons Fossiles*" by Murchison, Buckland, Lady Gordon Cumming, and other coadjutors in his work. Among them are several type specimens which are commonly supposed to have been lost. Among Stonesfield fossils from Oxford there is the original and almost unique tooth of *Ceratodus phillipsi*, named but not described by Agassiz. The original scute of *Phyllolepis concentricus*, Ag., from the Upper Old Red Sandstone of Perthshire, communicated by Murchison, is also there. Lady Gordon Cumming's contribution from Tynet Burn includes several figured and described specimens. The original supposed jaws named *Plectrodus mirabilis*, from the Ludlow Bone-bed, figured in Murchison's "*Siluria*," are also in this collection. It is unfortunate that these valuable fossils cannot be transferred to some more appropriate resting-place where they would be properly labelled and appreciated.

THE grants for scientific purposes at the British Association of interest to our readers were as follows:—Geology Erratic Blocks, £15; Geological Photographs, £10; British Carboniferous life-zones, £10; Irish Elk in the Isle of Man, £15; Prehistoric Flora and Fauna in Canada, £30; Drift section at Moel Tryfan, £5; Ty Newydd Caves, £40; Caves at Uphill, £30; Zoological Station, Naples, £100; Biological Laboratory, Plymouth, £20; Index generum et specierum animalium, £100; Migration of Birds, £15; Apparatus for keeping aquatic organisms under definite physical conditions, £15; Plankton and physical conditions of English Channel, £100; Exploration of Socotra, £35; Lake Village at Glastonbury, £50; Ethnological Survey of Canada, £35; 'Anthropological Notes and Queries,' new edition, £40; Age of Stone Circles, £20; Physiological Effects of Peptone, £30; Electrical Changes accompanying Discharge of Respiratory Centres, £20; Influence of Drugs upon the Vascular Nervous System, £10; Histological Changes in Nerve Cells, £20; Micro-Chemistry of Cells, £40; Histology of Suprarenal Cap-

sules, £20; Comparative Histology of Cerebral Cortex, £10; Fertilisation of Phaeophyceae, £20; Assimilation in Plants, £20; Zoological and Botanical Publication, £5. A total amount of £1495 which appears to be the record amount for one year.

THE fiftieth anniversary of the American Association for the Advancement of Science was eminently successful; 903 members attended. Dr Alpheus S. Packard read a paper on "A Half-Century of Evolution, with Special Reference to the Effects of Geological Changes on Animal Life," a full report of which appears in *Science* for Sept. 2.

THE Report of the Second Triennial Conference of the Irish Field Club Union, which took place July 7 to 13, is published in the *Irish Naturalist* for September. The report is fully illustrated by Mr R. Welch's beautiful photographs, and contains a general account, reports on Arachnida, Hymenoptera, Lepidoptera, Coleoptera, Hemiptera, Mollusca, Botany, and Geology, by specialists in the various groups.

THE Natural History Society of New Brunswick increased by thirty-seven members last year, and this according to the Thirty-Sixth Annual Report is a satisfactory state of things. We should like to see the list still higher, for the Society publishes useful and valuable information concerning the province, and maintains a Museum on which it spent 88 dollars in 1897 out of an income of 471. From the *Bulletin* of the Society we learn that the Fredericton Natural History Society, which was founded in 1895, held nine meetings in the winter 1897-8, and through its efforts the schools of the city of Fredericton have been supplied with sets of common minerals for class use, while the High School is being fitted out with a set of minerals of New Brunswick, a very excellent educational effort. We also learn from the same source that Kings County Natural History Society, which was founded in 1897, holds regular meetings the first Saturday in each month, has fifty-two names on its roll, and is divided into five sections—geology and mineralogy, botany, zoology, ornithology, and entomology—much after the style of our own Croydon Microscopical Club and others, and each section is in charge of a committee of three.

FROM the Annual Report of the Straits Branch of the Royal Asiatic Society for 1897 we note that the income for the year was 1473 dollars, of which 654 were used for the publication of No. 30 of the Journal, while no less than 600 remain as balance. The membership has increased. No. 31 of the Journal is in the printer's hands, and the new map of the Malay Peninsula by Mr van Cuylenburg has been sent to Mr Edward Stanford for publication, and he hopes to have it ready in February.

THE British Mycological Society held in September a successful long excursion in Dublin. The *Irish Naturalist* will publish a full report.

THE Société de Spéléologie founded in 1895 has fully carried out its programme. *La Feuille des jeunes Naturalistes* points out that the Society has subsidised Mr Sidérides' work in Peloponesus, that of the Cévenot Club in Les Causses, and the work of Viré, Chevrot, Bidot, Küss, Guérillot, and others in the Jura, as well as some operations undertaken by Mr Voisin, to render accessible the Grotte de Baume-les-Messieurs in the Jura. The Society has published eleven *Bulletins* with a total of 496 pages, and ten *Mémoires*, all fully illustrated, which form a valuable scientific record. There are now 220 members; the subscription is only fifteen francs, and the Society is housed at 7 Rue des Grands-Augustins, Paris.

THE Department of Agriculture of the Cape of Good Hope has issued as "G. 53-'98" the "Report of the Marine Biologist for the year 1897" by Mr J. D. F. Gilchrist. In the report for 1896 and in the present report reliable informa-

tion has been published relative to the fishing industry and fishing centres of the Colony. The Colonial Government is now in a position to appreciate the value of this important industry and the possibilities of its development, and to legislate on matter which may arise in regard to it. In order to satisfactory investigate the fishing grounds one of the most modern types of steam vessels was procured, together with a skilled crew, and they set to work with long lines, nets, and trawl. So far it is found that there is within easy reach of Cape Town an excellent trawling ground, rivalling the North Sea in productiveness, and among other excellent fish, soles occur there abundantly, some of them turning the scale at 8 and 9 lbs, from near St Helena Bay. The future work of the "Pieter Faure" as the vessel is called will be the investigation of the Agulhas Bank from Mossel Bay and Port Elizabeth, Knysna, Port Alfred and East London. The scientific aspect of the work will be kept in sight (see *Natural Science*, October, p. 228) but for the present more attention must be given to the industry. Considerable opposition has been made to the operations of the steam trawler, but it has been pointed out that Parliament was only experimenting at present, that proper investigation would be made into the alleged disturbance of spawn, and the fishing limits for ordinary fishermen, but that the store of food available round the coast would certainly be exploited in a country clamouring for cheap food, and that the interests of a large country would outweigh the interests of a few individual fishermen. The report contains some valuable charts, descriptions of a new *Arnoglossus* by Mr Boulenger, and a new genus of gasteropoda *Neptuneopsis gilchristi* by Mr G. B. Sowerby, besides much other statistical information.

THE general conference of the International Geodetic Association met at Stuttgart on October 3. Among other matters a programme for a systematic study of variations of latitude, involving the occupation of stations for a term of years, was arranged. Two stations will be in the United States, one in Italy, and one in Japan.

WE learn from the *American Geologist* that the International Mining Congress will meet again in 1899 at Milwaukee. The meeting at Salt Lake City in July had an attendance of about 200. One of the chief objects of the Congress is to recommend amendments to the mining laws of the United States.

THE Second International Congress of Marine Fisheries was held at Dieppe on September 2, under the presidency of Mr Perrier. There were four sections: (1) For scientific research under Mathias Duval; (2) Apparatus, preparation and transport under Delamare-Deboutville; technical education under J. E. Seigneur; (4) Fishery rules under Mr Roche. Numerous communications were made to the Congress.

THE Tenth Congress of Russian naturalists and physicians was held at Kiev on September 3, under the presidency of Mr Bunge. Over 1500 members were present.

THE Fifth International Congress of Physiologists will be held at the University of Turin towards the end of September 1901.

THE Library of the Millport Marine Biological Station has received a nearly complete set of the "Challenger" publications.

COUNT CARL LANDBERG, the Bavarian orientalist, will be the leader of the expedition projected by the Vienna Academy of Sciences, to Arabia. The Swedish steamer 'Gottfried' took the party from Trieste towards the end of October. Prof. Simony goes as botanist, Dr Kossmat as geologist. The chief objects of the expedition are Sabaean inscriptions, pre-Arabic archaeology, and the Mahra language. Dr Layn will go as physician.

WE learn from the *Times* that Dr A. G. Nathorst's Swedish Arctic expedition has returned safely to Tromsø. The expedition was most successful, the natural history of King Charles Land is now completely known, and some important hints between the geology of Franz Josef Land and Spitzbergen have been established. Bear Island was surveyed and mapped by Lieut. Kjellström and Dr Hamberg, as also was King Charles Land, the former on a scale of 1:50,000, and the latter of 1:100,000. Bell Sound was also mapped and the Greenland ice-pack was touched at 78° 1' N. lat., 4° 9' W. long. The geology of White Island was ascertained, and the island was found to be covered by an ice-cap from which table bergs are constantly given off. Passing on to Charles XII. Island the expedition visited Freuenberg Bay, Grey Hook, and Danes Island, after which a circumnavigation of Spitzbergen and its surrounding islands was completed. Large collections have been brought back.

WE learn from the *Athenæum* that a new scientific expedition to Central Asia is being furnished by the Imperial Russian Geographical Society in Kasan. The leadership of the expedition is entrusted to Prof. Sorolin, and all the other members of the expedition are professors of the Kasan University. A preparatory sum of 20,000 roubles has been granted towards the cost. The expedition will shortly set out towards Nora, in Central Asia, where the members will pursue geographical, ethnographical, and geological studies.

ALSO that a Dutch deep-sea expedition, under the conduct of Prof. M. Weber, of Amsterdam, is also to start from Holland during the present autumn. Its range will be less extensive than that of the German deep-sea expedition, as it will be limited to zoology, botany, and oceanography within the eastern part of the East Indian Archipelago.

MESILLA PARK has started a science club, under the presidency of Mr C. M. Barber.

BARNARD COLLEGE, U.S.A., will shortly equip a botanical laboratory to be named in memory of Prof. Emily L. Gregory. The Botanical Club have subscribed 500 dollars as a nucleus to the fund.

It is proposed to erect a Biological Station in the Bermudas. Prof. C. L. Bristol of New York University has gone there with a party of students.

ACCORDING to the *Times* of Oct. 1, a specimen of the 'takahe,' the large rail of New Zealand, *Notornis mantelli*, has recently been found. This bird was first recognised by Owen in 1847 in a collection of bones sent home by Walter Mantell, the types of which are in the British Museum. A second specimen was obtained from Middle Island by some sealers in 1849, and this was also acquired by Mantell. In 1852 a third individual was killed on Secretary Island, the skin of which was preserved. The remains of these two are preserved at the British Museum. No further trace of the bird was seen till 1879, when one was caught alive near Lake Te Anau by a hunter who killed it; it was secured by a Mr Connor, who sold the specimen in London in 1882 by auction for £110, and it is now in Dresden. Fragments of a fifth specimen were found in 1884 also near Lake Te Anau, and these went to Dunedin. The new find makes the sixth recorded specimen of a species evidently rapidly approaching extinction. Another and later letter to the *Times* stated that the writer could furnish as many specimens as wanted.

AN interesting balloon ascent was made on Thursday, September 14, by Mr Stanley Spencer and Dr Berson, who reached the altitude of 27,500 feet, only some 1500 less than Coxwell and Glaisher's record of 1862. They descended near Romford after being up some four hours. At 25,000 feet the aeronauts had to breathe compressed oxygen. Numerous observations were made, the results of which are awaited with considerable interest.

## CORRESPONDENCE

## THE EVOLUTION OF HORNS

MR J. T. CUNNINGHAM's article is too long for detailed criticism in the correspondence columns of *Natural Science*, but perhaps I may be permitted to meet his remarks concerning horns. I take it that the Neo-Darwinian theory of the evolution of horns is as follows. Other things equal, when the hornless ancestors of horned ruminants first began to fight by butting, those individuals best succeeded in the struggle which had skulls most adapted for that mode of combat, *i.e.* those which had the thickest and toughest frontal bones. The next step, after the evolution of strong and solid frontal bones, was the survival of such individuals as had bosses of bone where the impact of the blows most fell. Lastly, the continual survival of those that had the bosses best developed led in time to the evolution of antlers. In the Bovidae a casing of cornified skin was evolved in addition to the bony projections.

Mr Cunningham asks, "Firstly, why do the antlers only begin to develop when the stag becomes mature. Secondly, why are they renewed every summer and drop off in spring." The answer appears to me simple. As he says, "it is at least significant that the males only fight when they begin to breed, and when mature only in the breeding season." It follows, since antlers are used only during the breeding season, that at all other times, being very heavy and cumbersome, they are not only useless, but much worse than useless. They are then causes of elimination only. Natural Selection has, therefore, not only evolved antlers, but has also fixed the times of their appearance. They are not needed by the immature stag, and therefore he has them not. They are not needed by the mature stag after the breeding season and therefore he sheds them, just as in cold climates animals shed their winter coats when the return of spring renders these not only useless but worse than useless. The horns of the Bovidae being much lighter are much less cumbersome than antlers, and for that reason are not shed.

Mr Cunningham attributes the evolution of horns to the stimulation of butting. The primary objection to this is that which applies against all arguments for the transmission of acquired traits, *viz.*, that it is highly improbable that alterations in the soma can affect the germ cell in such a manner that the parental modification is produced in the descendant organism: in other words, it is highly improbable that the modification which butting produces in the frontal bone of the stag can so affect his spermatozoon, situated as it is far distant, that after long separation from the parent organism and union with another germ it develops into an individual which has inborn the special peculiarity the parent acquired. *A priori* the transmission of acquired characters seems impossible, and the onus of proof therefore rests with the upholders of the Lamarckian doctrine. Suffice it to say that the organic world has been ransacked, and no indubitable instance of such transmission has ever yet been proved. Moreover, there is a special objection to Mr Cunningham's theory concerning the evolution of horns, *viz.* this, that horns do not grow under the stimulation of butting as he seems to imply. Both in the young deer and the adult they complete their growth before the animal begins to fight; during the fighting season they do not increase a grain in weight. If then use, *i.e.* stimulation, does not cause their development in the individual, it cannot of course have caused their evolution in the species.

G. ARCHDALL REID.

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## VACCINATION

IN the note in September's *Natural Science* on the above subject, it is stated as proved that vaccinia is merely attenuated small-pox. Prof. Crookshank, in his "Bacteriology and Infective Diseases," fourth edition, 1896, in reference to experiments made to prove the identity of the diseases, says: "The results of these experiments have been very generally misinterpreted, and claimed by some as conclusive evidence of the identity of cow-pox and small-pox. Instead of the vesicle being regarded as the most attenuated form of variola, the experimenters are said to have succeeded in producing cow-pox. It is quite true that they produced phenomena indistinguishable from the phenomena of an ordinary vaccination, but that does not mean that they produced the disease cow-pox. The vesicle which followed the inoculation, whether papular or vesicular, was

small-pox. Ceely, Badcock, Voigt, and others, succeeded in engrafting the cow with small-pox, and when suitable lymph and suitable subjects were employed, the virus was so attenuated that a benign vesicle resulted. Similar results were obtained by Sutton and Dimsdale, and identical results by Adams, Guillou and Thiele, by inoculating the human subject with variolous lymph without first engrafting the disease on the cow. Vaccination with variola vaccine is simply a modification of the Suttonian system of small-pox inoculation, only in the first remove the cow is substituted for the human subject." And, in the same connection, Prof. Crookshank adds: "Cow-pox has never been converted into human small-pox, and, in their clinical history and epidemiology, natural cow-pox and human small-pox are so different, that the comparative pathologist is no more prepared to admit their identity than he is prepared to admit the identity of cow-pox and sheep-pox, or small-pox and cattle-plague." Of course these statements are not necessarily conclusive, but they are valuable in showing that, even among those qualified by experience to form an opinion, the identity of the two diseases in question is not regarded by all as proved. U.

#### ANTARCTIC EXPLORATION

In a special Antarctic number of the *Scottish Geographical Magazine*, received just as we are going to press, Sir John Murray urges the need of a British Antarctic Expedition. The importance of such an expedition has been insisted upon more than once in these columns, and we hope that Sir John Murray's efforts will assist in impressing the mind of the Government. Our maps are a feeble blank concerning Antarctica, and the information we possess as to its fauna and flora is inconspicuous. A few Cetacea, a few seals, and a handful of birds are all that Mr Chumley can record, while as to the Invertebrata, practically all we know was gained in a few dredgings by the "Challenger," during the cruise from the Cape of Good Hope to Australia. Dr Murray's plea is not for a dash to the South Pole, but for a "steady, continuous, laborious, hydrographical and topographical examination of the whole South Polar Area during several successive years" . . . which "would enrich almost every branch of science, and would undoubtedly mark a great advance in the philosophy of terrestrial physics." He asks some of our wealthy citizens to come forward with £100,000, which might be placed in the hands of the President of the Royal Society.

#### NOTICE

TO CONTRIBUTORS.—All Communications to be addressed to the EDITOR of NATURAL SCIENCE, at 29 and 30 Bedford Street, London, W.C. Correspondence and Notes intended for any particular month should be sent in not later than the 10th of the preceding month.

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